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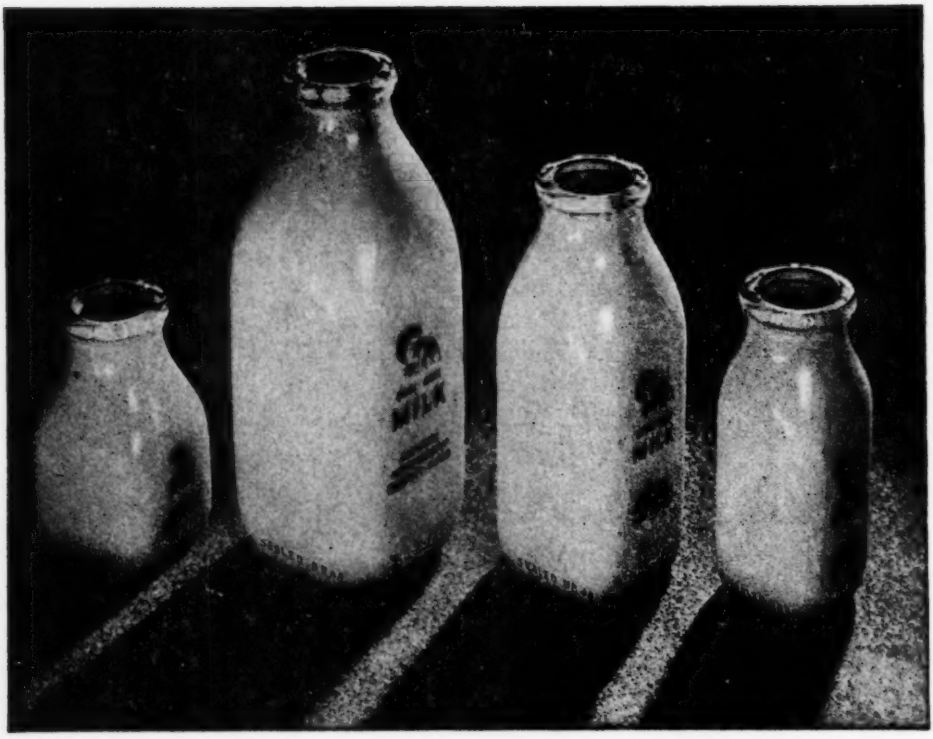

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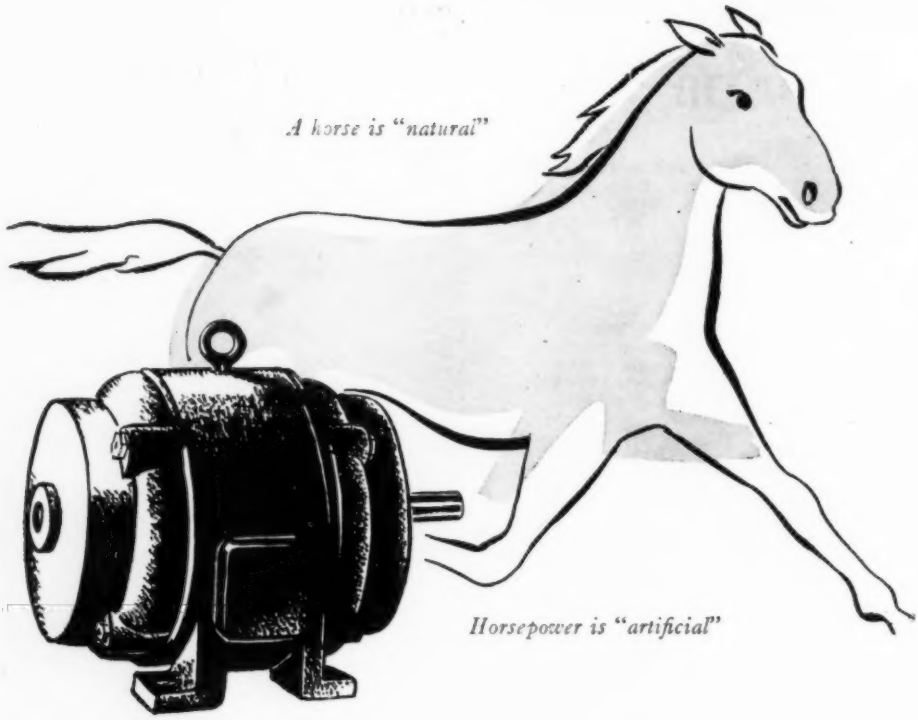

THE DAIRY INDUSTRY USES BOTH!

The klip-klop of the milkman's horse bringing man's "most nearly perfect food" is still a welcome sound. The whirr of the electric motor churning ice-cream is no less so. Shouldn't we stop using that word "artificial" loosely? Nature and Science team-up to produce Michael's Mixevan. Vanilla beans from the tropical orchid-plant. A synthesis of vanillin from those same tropics. The result? *Controlled Flavor* in your mix, to make "VANILLA" on the flavor-board mean what it says . . . to make mouths water throughout your sales-territory.

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September 9, 1946
to Columbus (15) Ohio.

The move is made to further expedite the service to Jersey Breeders by being more centrally located and in a more favorable labor market.

This move means that a caravan of vans will be required to take Jerseydom's 200,000 lbs. of records and equipment to Columbus. The files are estimated to contain more than 10,000,000 individual data recordings.

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JOURNAL OF DAIRY SCIENCE

VOLUME XXIX AUGUST, 1946 NUMBER 8

ABSTRACTS OF PAPERS PRESENTED AT THE FORTY-FIRST ANNUAL MEETING

EXTENSION SECTION

D.H.I.A. WORK

E1. Considerations in the Development of the Dairy Herd Improvement Association Program. KENDRICK, J. F., Bureau of Dairy Industry, U.S.D.A.

The need for more efficient producing dairy cows is greater today than ever before. More people are using more milk and milk products in their daily diets than ever before. All indications are that the present high demand for milk will not only continue, but that it will actually increase in the future. The human population, consumers of milk, is increasing. The dairy cow population remains about the same, actually decreasing during the last year.

More milk must be produced per cow; that is, the producing efficiency of the dairy herds of the Nation must be increased if the total milk supply is to be increased.

The Dairy-herd-improvement-association program as developed by the extension services in the various States is specifically designed for improving the producing efficiency of the general cow population. The program has been operating in this country for 40 years. Much has been accomplished. In the 40-year period just ending, association herds have been improved until at present the average butterfat production of association cows is 336 pounds per year. The results of the D.H.I.A. program afford sufficient proof that it is possible, practical, and profitable to improve dairy herds.

The butterfat production of the average cow of the Nation is only about 190 pounds per year. The low producing efficiency of the herds as a whole is a challenge to the leaders in the D.H.I.A. program. They must devise methods (1) for more rapidly spreading the improved and successful practices that have been developed in association herds to all herds and (2) for disseminating widely the wealth of information now at hand which will bring about the gradual improvement of all dairy cattle.

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E2. More Accurate Records on More Cows through County Testing Laboratories. J. E. STALLARD, Extension Dairyman, University of Wisconsin.

This paper will show how the number of cows on test has been materially increased in Wisconsin through the county cooperative testing laboratories, even in wartime. It will point out more accurate work because of sufficient and efficient equipment under ideal laboratory conditions. It will show how many herds, not previously interested, have been reached.

It will also show the development of systems and forms that assure greater accuracy in both identification of samples, clear tests, and more efficient use of personnel.

It will show greater ease of supervision from both the state and county levels, with more assistance to Extension by boards of directors.

Illustration by slides and exhibit will be made, if possible.

E3. Evaluation of Pasture in D.H.I.A. Records. R. B. BECKER, University of Florida.

How should pasture be valued in D.H.I.A. records? Should it be on cost of producing the pasture, or on amount of nutrients obtained by the cows? This summary is based on replies from 48 states to 7 points raised in a questionnaire by the Committee on Pastures and Forages?

Methods of valuing pastures frequently vary between associations within a state, as situations and conditions differ. More frequently the D.H.I.A. supervisor sets the charge for pasture, often in conference with the owner, and sometimes the County Agent. The D.H.I.A. members or Boards set pasture prices in 2 states; Extension and Experiment Station staff jointly in 1 state, while the Dairy Specialist advises or furnishes a guide in 4 states. Three grades of pasture, as good, medium, and poor, often are used to indicate quality.

Estimated carrying capacity (amount and quality of forage) is the basis of valuing pastures in 15 states; local rents in 15; some estimate of feed replacement in 7, and cost of producing pasture in 4 states. Generally, little or no distinction is made between permanent and temporary pastures other than amount and quality of forage. Nine states charge rent; 2, cost of production; 3, a higher rate than permanent pastures, and 2, on the basis of feed saved.

Two-thirds of the states reporting distinguished in price between grass, legume, and mixed pastures mainly on the basis of quantity and quality of forage, while one-third indicated no distinction.

"Hay-replacement" values were popular for calculating pasture charges in 3 states growing alfalfa under irrigation. Values were on the basis of hay, less costs of harvest and marketing. One state estimated good pasture equal to one-half the hay and silage replaced. Three states analyze some

yearly herd summaries, calculating pasture on a hay basis. In South Carolina, pasture returns are calculated in pounds of "Legume hay equivalent." A "feed level analysis" of yearly records is made in New York, using a pasture yield chart in computations. Feed records in Texas are converted to terms showing the proportion derived from pasture, computed by inverse calculation. In Utah and elsewhere, butterfat production of 138 to 211 pounds per acre of pasture has been computed by inverse calculation. California is making a separate herd management study based on a 1000-lb. cow as an "animal unit," calculating the amount of pasture equivalent to 1,000 pounds of alfalfa hay, or 500 pounds of total digestible nutrients. These methods have been desirable educational tools.

Logical objections to hay-replacement values were expressed regionally, mainly that local hays varied in kind and grade, and that hay prices are established late in the season. The amount of hay or roughage fed to supplement pasture during dry weather is an index to lower pasture charges in several areas.

Winter pastures are used mainly south of the Potomac and Ohio rivers, in the winter wheat belt, and the southwest. Amount of grazing is estimated in 9 states along the northern border of this zone. The supervisor's judgment of benefits derived is the main basis of evaluation in 10 coastal and southwestern states.

A tendency to under-value good pasture was a major criticism. Some definite simple guide is needed to value pastures fairly, either on cost-of-production and maintenance, or a nutritive basis, according to 18 states, several of which are studying the problem. Dormancy of some pasture plants in summer drew 3 remarks about annual crops. Economical production from good pastures was emphasized from 3 widely separated areas. Two states are concerned in a "pasture contest" and a "pasture demonstration record." When excellent pastures are charged on a cost-of-maintenance basis, nutrients from pasture are valued under their worth.

It is believed in 1 state that pasture returns can be expressed by the difference between winter feed costs and summer, per 100 pounds of milk. Farmers in 1 state insisted on a flat rate for pasture during the season, regardless of forage yields. None of the suggestions or criticisms mentioned maintaining productivity of the land, although several cost-of-production methods mentioned fertilizer charges.

In general, it appears that pasture valuation should be divided according to regions and practices. More study can be devoted to establishing simple standards for pasture valuation. The question of "cost-of-production" or of "nutrients provided" should be decided by responsible persons in regions, states, or within parts of a state depending on situations peculiar to such areas. The criterion should be how well a method provides the information desired by the cooperating D.H.I.A. members.

Extension Section	*Production Section*
E. T. Itschner, Missouri	R. E. Hodgson, Washington, D. C.
A. R. Merrill, Connecticut	R. H. Lush, Washington, D. C.
E. C. Scheidenhelm, New Jersey	R. B. Becker, Florida, Chairman

E5. Effective Use of Herd Records. RUSSELL E. HORWOOD, Michigan State College, East Lansing, Michigan.

Dairy farming is a business. In many sections and on many farms it is the major agricultural enterprise. Record keeping is an important part of any business. It is an essential chore the same as feeding, milking or testing. The extent of the value of records depends upon their use in developing and maintaining an efficient herd. The following charts indicate ways of summarizing records to give a clearer picture of the exact situation within a herd. A study of the conditions indicated by the charts will suggest procedures that will aid in placing the herd on a more efficient basis. Additional studies of a similar nature may be made following the plan outlined. *The greatest value in keeping such records may come from comparing the current record* with similar records kept in previous years.

Chart 1. If this chart is completed each year it will provide a convenient summary of the number of animals in the herd by age groups. It will provide much of the information upon which a two-year sales program for females and a year's program for bulls may be based. In addition the data should be an aid in developing an inventory of the herd.

NUMBER OF ANIMALS IN HERD AT END OF TESTING YEAR

Year	Calves under 6 mos.		Older bulls for sale	Heifers 6 mos. to freshening	Cows
	Heifers	Bulls			

Chart 2. When this chart is completed it may show that you have a young herd. In such a case a larger sales program may be planned than if the average age of the milking herd is further advanced. It may be an aid in deciding upon the animals to sell if these data are compared with the production data in Charts 5 and 6. It is well to keep in mind that on the average a cow stays in the herd only four years. If the herd can be operated

AGE IN YEARS OF COWS IN HERD AT END OF TESTING YEAR[1]
(Designate cows by name or herd number)

Year	Range in age (years)										
	2	3	4	5	6	7	8	9	10	11	Over 12

to extend the useful life of the animals beyond this period it increases efficiency greatly.

Chart 3. A study of the data in this chart will indicate the success the herd is having in breeding heifers to freshen at the desired time and age. If results are not satisfactory it will be important to determine the cause. It may be due to carelessness, lack of fertility on the part of the bull, or disease in the heifers. When the cause is determined steps may be taken to change the condition. Heifers freshening at an advanced age may generally be expected to produce more during the first lactation. Likewise the opposite may be expected from heifers that freshen at a very young age. Records made under such conditions frequently lead to over or under evaluation of such animals from the standpoint of future production and production expectancy in their offspring.

AGE IN MONTHS OF HEIFERS AT FRESHENING DURING TESTING YEAR[1]
(Designate heifers by name of herd number)

Year	Range in age (months)										
	24	25	26	27	28	29	30	31	32	33	Over 34

[1] Compute average age at end of each year.

Chart 4. The data in this chart will reveal the freshening interval for each cow and for the herd as a whole. This information has been given little consideration except when the interval has been unduly long. In general, dairymen prefer to have cows freshen at 12-month intervals. Studies made in Iowa herds carrying on Dairy Herd Improvement Association testing show the average interval is approximately 14 months. A study made in Michigan shows a higher average daily fat production for cows with a freshening interval less than 365 days as compared to longer freshening intervals. The shorter freshening interval will tend to increase the herd average. It will also lower the individual lactation record. The lower lactation records may reduce somewhat the prices that cattle may be sold for until more consideration is given on the part of the purchaser to the length of the record and the freshening interval in connection with the record. There is a trend toward greater use of the 10-month record.

FRESHENING INTERVAL IN MONTHS OF COWS IN HERD[2]
(Designate cows by name or herd number)

Year	Range in months								
	11	12	13	14	15	16	17	18	Over 18

[2] Compute average interval at end of each year.

The interval may generally be shortened by breeding cows at the first heat period following approximately six weeks after freshening. If the cow does not conceive on this breeding there is an opportunity to breed again at the next period and maintain a 12-month interval. The number of services per conception is close to two on the average. It is generally believed that cows bred in the earlier heat periods following freshening conceive more readily.

Chart 5. The high lactation records of the cows in your herd as listed here may point to the individual animals that have the greatest producing ability. Abnormal factors such as a long freshening interval, cystic ovaries and excessive feeding should be considered to avoid over evaluating such an animal. Likewise, the low production of some cows should not lead to underevaluation if interfered with by such factors as mastitis, abortions, or underfeeding. The repeatability of performance should be watched in each animal and also in her offspring.

DISTRIBUTION OF HIGH INDIVIDUAL RECORDS OF COWS IN HERD AT END OF TESTING YEAR REGARDLESS WHEN MADE
(Designate cows by name or herd number)

Year	Range in production (lbs. fat)							
	Heifers incomplete	200–300	300–400	400–500	500–600	600–700	Over 700	Average

Chart 6. A study of the distribution of lactation records within the herd each year will indicate the range of production that exists. The high records will indicate to some extent the inheritance for production that the sires to be used should carry. It will point out to some extent the lower producing animals that may be profitably eliminated. The repeatability of records may be observed if the data are studied from year to year.

DISTRIBUTION OF LACTATION RECORDS COMPLETED DURING YEAR
(Designate cows by name or herd number

Year	Range in production (lbs. fat)							
	Heifers incomplete	200–300	300–400	400–500	500–600	600–700	Over 700	Average production

Chart 7. The loss of cows from the herd from causes other than dairy purposes in various studies runs from 15 to 20%. An actual record of such losses within a herd from year to year will indicate the place to put the major stress to overcome this. If it is due to low production it may be

caused by several factors as poor bulls, poor feeding or management, or a combination. Excessive loss due to mastitis would indicate an improved mastitis control program. Shy breeders may indicate greater use of a good veterinarian.

CAUSE OF REMOVAL OF COWS
(Designate cows by name or herd number)

Year	Number of cows in herd	Dairy purposes	Low production	Removal mastitis	Shy breeders	Other causes	Per cent of cows lost

Chart 8. Studies in several states indicate that from 12 to 20 per cent of the female calves born never become producing cows. This is a tremendous loss. The extent of these losses and their cause is important to the herd operator. After they are known a program to overcome them may be of utmost value. The calves must be raised for herd replacement, or sale if the full value of the inheritance of the sire and the cow are to be secured. Greater returns may be expected if these losses are kept at a minimum.

DISPOSITION OF CALVES BORN

Years	Sex	Number born	Intentions for		Sold for		Died	Age	Cause	Per cent loss
			Replacement	Sale	Breeding	Slaughter				
	Male									
	Female									

BREEDS RELATIONS COMMITTEE REPORT

B. Program of the Purebred Dairy Cattle Association. G. A. BOWLING, Port Chester, New York.

The objectives of the Purebred Dairy Cattle Association are set forth and a brief summary is given of the following projects, which are a part of the program of the Association.

1. Uniform Score Cards for Dairy Cattle.
2. Uniform Rules of Official Testing.
3. Uniform Rules for Proving Sires and Dams.
4. Uniform Rules for Artificial Insemination.
5. Uniform Rules for Herd Type Classification.
6. Rules and Ethics for Public and Private Sales.
7. Uniform Rules for Interstate Movement of Dairy Cattle.
8. Uniform Classes for Dairy Cattle at County and State Fairs.
9. Better facilities for Livestock Photography at State and National shows.
10. A Dairy Cattle Breeding Research Council.

The relationship of the Association to the breed registry organizations and the general dairy cattle improvement program is explained.

D. Uniform Rules for Official Testing. FLOYD JOHNSTON, Iowa State College, Ames, Iowa.

Since April, 1941, a joint committee representing the American Dairy Science Association and the Purebred Dairy Cattle Association has been working on uniform rules for official tests which can be used by all dairy breed registry organizations.

These rules amalgamate those adopted by the American Dairy Science Association with those recommended by the Purebred Dairy Cattle Association and show the points of difference, where there are any, from the uniform rules of each of the five breed registry organizations.

When put into use, the one set of regulations will replace the 7 now in use and will be a great forward step toward uniformity and the results will be most helpful to the colleges and breeders and to students of the official testing program.

F. Program Suggestions for Inter-Breed Groups. E. C. SCHEIDENHELM, Rutgers University.

Programs developed by inter-breed groups within states should, in a large measure, develop an action program on a state level similar to that of the national breed associations on a national basis.

The success of state groups depends upon the leadership they have and the desire of the breed groups to "give and take" to help reach a reasonable solution to this problem.

Activities can largely be grouped into two classes, namely; educational and non-educational.

I. Educational.
   a) Active support to the 4–H club program on a uniform basis.
   b) Uniform program in recognizing meritorious sires.
   c) Assistance in arranging programs for Farmers' Week programs.
   d) Suggestions for extension program on breeding, programs, production testing, etc.
   e) Assistance to artificial breeding groups in setting up standards for sires and otherwise aiding the breeds with mutual problems.
   f) Educational dairy programs at fairs and exhibitions within states.
   g) Recognition of outstanding leadership to the industry.

II. Non-educational.
   1. Securing proper legislation for health regulations.
   2. Developing uniform standards for dairy shows on county, district and state bases.

3. Setting up ethics for sales.
4. Developing an advertising program for cattle industry of the State.

The success of an inter-breed organization depends upon the continuity of activity. At least three or four meetings should be held during a year. Representatives to the inter-breed group from the respective participating breed organizations should always keep their own groups fully informed of the activities of all meetings.

ARTIFICIAL BREEDING

E9. Some New Management Methods for Artificial Breeding Associations. E. J. PERRY, Rutgers University.

Among some of the newer methods of management reported as now being practiced by artificial breeding units in a number of the states and one foreign country are the following: 1) The use of a standard letter and a well-prepared set of questions and answers for mailing to prospective members, 2) A state association council of breeding associations to aid in unifying and standardizing the program and helping to determine policies of state-wide interest, 3) A high minimum standard of genetic excellence for both proved and young bulls, which must be met before they are acceptable for cooperative breeding project (utilizing the breed average or other measure), 4) The setting up of bull-testing stations—a special plan for improved control of environment in proving bulls by assembling sufficient daughters two months prior to freshening and subjecting them to identical feeding and management methods while on production test, 5) Giving additional free services, above the first three to "trouble cows" when the whole herd is enrolled, 6) Having a state-wide standard method of clean-up for technicians before leaving the farm, 7) Advertising in local papers using a key headline and presenting new important current information each week or month dealing with the bulls' progeny, production and type, etc., 8) A central clearing house on sire information to which reports on all bulls purchased, leased or rejected will be sent, 9) Special on responsibility to members in new territory, making certain that they get accurate information regarding results to be expected, thus preventing a good many disappointments, 10) Buying or leasing bulls on fertility contracts, 11) Supplying all members with cow breeding and management calendars, 12) To reduce chance of syringe contamination to a minimum either refrigerate syringe after each insemination or use dry syringe along with an inseminating rod that is large enough to carry a little more than a cc. of semen.

A number of these practices are meeting with favor because of results produced and are therefore, deserving of careful consideration by associations that have not yet adopted them.

E10. Schools and Program for Training Inseminators. RAYMOND ALBRECTSON, Cornell University.

It is self-evident that the success of an artificial breeding association rests heavily on the skill, tact and efficiency of the inseminator employed. Good organization, large cow enrollment and membership enthusiasm rapidly deteriorate under the corroding effect of poor conception rates attributable to poor technique. Basically, farmers' cows must be gotten with calf artificially at an efficiency closely approximating or equal to natural service. In addition to good insemination technique, a technician must have a well-developed sense of responsibility, a pleasing personality and an enthusiastic appreciation and understanding of the fundamental purpose of the program, viz., herd improvement through use of desirably proved sires.

It became apparent early in the development of this program in New York that a definite system of training schools or short courses for insemination technicians was necessary. Since 1941, twenty-five short courses have been held with a total enrollment of 474. Definite scholastic requirements are not prerequisite. A history of dairy farm experience is considered desirable. Experience has shown the men under 21 years of age and those lacking a farm background to be disappointing in the course and out in the field. No other objective measures have been found to date that are reasonably reliable in selecting enrollees.

The organization of the short course is such as to give as much usable basic information and practice as possible in eleven days. All presentations are designed to stimulate each enrollee's ability and aptitudes. That is all any short course can hope to do. The subjects are arranged in a sequence very similar to the development of the program in the field. Lectures on physiology, bacteriology, genetics, organization and record keeping are supplemented with practice periods on insemination technique, preparation and sterilization of equipment and financial and breeding records. Emphasis is placed on correct procedures. Each enrollee has his work checked as to its quality in every operation. About one-half of the entire course is given over to insemination practice and closely allied techniques.

A short course of this kind cannot produce *completely trained technicians*. It is impossible to do that in the short time allotted. Experience has shown conclusively that men attaining a high rating in the course have become good technicians under field conditions. Equally conclusive is the unsatisfactory performance of men rated in the lower half of the class. It appears that the aptitude for this work is an attribute not possessed by all people.

A system of written quizzes and careful observation of practice techniques is used to grade the enrollees. The personality, attitude and previous experience and training of the enrollee is also considerd in the final grading. The highest grade given is "1"; the lowest is "5." Enrollees earning a

grade of "1" or "2" will invariably be successful. Some grade "3" men will not be successful. Men earning grades below "3" cannot become approved technicians in New York.

After employment each technician is checked by either an Extension Specialist or an inseminator-at-large employed by the New York Artificial Breeders' Cooperative, Inc. This check-up is for the purpose of giving the new technician confidence and to forestall undesirable habits or practices.

The inseminator training course as given in New York has gone through many progressive steps in its development. There appears to be several improvements that can be made to strengthen the effectiveness of this short course. Among them are the following:

1. A better means of selecting candidates.
2. Limitation of total enrollment to a maximum of 40.
3. Improve teaching methods—simplified instructions plus visual aids.
4. More practice periods, possibly fewer lectures.

4-H CLUB WORK, QUALITY PROGRAMS

E11. New Developments in Calf Club Work in Pennsylvania. J. C. NAGEOTTE, Pennsylvania State College.

Our calf club work in Pennsylvania has suffered in quality during the war years. We have had fewer meetings, shortage in labor has caused a deterioration in the quality of the work, good calves have been higher priced and fewer can be obtained and restrictions in travel have practically cut out calf club shows. The added responsibilities put on the county agents has also cut down on the attention the club members received. It has not been easy to correct this. We feel that our biggest loss has been in the showing program, and that if this is corrected the other things will automatically fall in line.

As fast as we can get it adopted we are starting a program of calf club round-ups in the communities. At these round-ups the club members are scored on the quality of the calf selected, on their showmanship, on the way the calf is developed and fitted for the show, and on their calf club record book. The best calves are selected at these community round-ups to be shown at a county show where they will be only judged on type with extra prizes awarded for the best fitted animals and the best shown animals. At these county shows a limited number of animals from each breed are selected to represent the county in a Regional 4-H Show where the animals will be judged on type as individuals within the breeds and in county groups of four or five for trophies. In no case will cash awards be given for placing, only ribbons are awarded for placing and what money the club members receive is given as a transportation allowance and each receive the same allowance for the distance traveled. The county furnishes their own money for the county shows and we have a promise from the State Breed Associ-

ations to support the Regional 4–H Shows on this basis. In the case where grade calves are owned they are only shown in the community round-ups. All the calves shown in the county and regional shows are registered calves and transferred to the club members.

A new development has entered into the picture this year with the American Jersey Cattle Club sponsoring a Junior Show at Columbus, Ohio, the second week in October. We were belatedly put on the advisory committee for this show and had no chance to work on the rules until they were set up and adopted. It is our thought that we can select our Jersey calves for the National Show at these Regional Shows and in this way make a calf club member and his calf earn their right to work up to the peak in the National Show. We recognize that this National Show will possibly have the same faults that the National Dairy Show had when the calf club calves were exhibited; that is the exploitation of club members for the benefit of some large breeders and breed associations. However, I feel that we can do more good on the inside working with them than we can by being on the outside criticizing what other people do when we don't participate. If each state will see to it that the exhibit they send to this show will be strictly a 4–H dairy exhibit in all sense of the word there cannot be much exploitation. If we all participate with the right spirit this commendable project could be carried on by all the breed associations cooperating and it would be a real incentive for club members to strive to get the best calves and do the best job in developing them, and finally in developing good herds for themselves.

E12. Extension Work in Quality Improvement of Dairy Products. AMER B. NYSTROM, Dairy Husbandman, Bureau of Dairy Industry, U. S. Department of Agriculture.

The paper emphasizes three specific procedures as follows:

1. See that in each State the whole college dairy staff—including instructors, research workers, and extension specialists—is thoroughly sold on the idea of improving the quality of milk and cream and that each member of the staff has a definite part in working out the plan for the State.
2. See that the plan includes a definite program for teaching rural youth the principles and practices of clean milk production, especially through 4–H dairy club and vocational agricultural activities.
3. Make full use of the processors and the managers of receiving stations in the quality improvement program by cooperating fully with them, both directly and through the State departments of agriculture and the State departments of health.

The address of Prof. R. B. Stoltz on "Organize for Quality," given before the American Butter Institute's annual convention in November, 1945, was

commended for reading. The following quotation from his address was cited:

"... any program to improve quality must be done by the creamery men themselves and not by the law enforcement officer nor the extension man in the College of Agriculture, nor the representative of the State Department of Agriculture. They can cooperate and work with them but the job must be done by the creamery men themselves. It is not necessary to have 100% participation, but you do have to have a majority, and probably 75 or 80%, and, of course, the greater the percentage, the easier the job is accomplished. I want to convince you creamery men that it is your responsibility, that you are the center of the universe when it comes to the quality, that you can't "pass the buck" to the law enforcement officer, your competitor or someone else. It rests upon your shoulders, for what you do will determine what the industry accomplishes."

MANUFACTURING SECTION

DRY MILK PRODUCTS

M1. A New Quantitative Method for Determining the Solubility of Milk Powders. J. FRANK CONE AND U. S. ASHWORTH, Department of Dairy Husbandry, State College of Washington, Pullman, Washington.

In a search for a more sensitive test than the American Dry Milk Institute (ADMI) method for determining the solubility of milk powders, we investigated less drastic methods for the reconstitution of the powder and also means of making the test more strictly quantitative. We have developed a procedure that differentiates quite reliably between powders that by the ADMI method appear to be almost completely soluble. It differs from the ADMI method in three main features: (1) Reconstitution is accomplished by a standardized procedure of manually shaking the powder and water in a flask instead of the vigorous mechanical agitation used in the ADMI method. (2) The entire reconstituted sample is employed instead of only a portion, as in the ADMI method. (3) The centrifuged sediment is not measured in volume units but is dried and weighed so that the results can be calculated in terms of per cent solubility.

Samples of spray-dried powder tested by the new method differed markedly in their solubilities, but for each sample the results were reproducible within narrow limits.

M2. Drying Milk by the Use of Cold. O. F. HUNZIKER, La Grange, Illinois.

Processes developed for drying organic substances by the use of cold have to do with drying from the frozen state. The prior art on this subject re-

veals U. S. patents granted as early as the beginning of the present century. These processes are essentially intended for batch operation. While they undoubtedly can be worked and a dry product can be produced, they are not considered of really practical importance and have not reached the stage of commercial development.

The basic principle involved in this method of drying is to subject the product to a very high vacuum. For example, if whole milk is subjected to a very low absolute pressure (high vacuum) such as 1/50-inch absolute pressure, the water is frozen out of the product in the form of very small ice crystals and the solid material that is left is practically bone dry. If the high vacuum is maintained and heat is applied to the product the ice will sublime, *i.e.*, it will change from a solid state (ice) to a gas (water vapor) without going through the liquefying state (water).

The success of the process depends upon the high vacuum and its sustenance. But the water vapor created during evaporation is very elastic material. As the pressure decreases (vacuum increases) the specific volume of water vapor increases. At atmospheric pressure at the sea level, 1 lb. of water vapor occupies approximately 13 cu. ft., but under high vacuum (absolute pressure 1/50 inch) each pound of water driven off from the product by sublimation of the ice crystals in the form of water vapor, occupies approximately 30,000 cu. ft. Hence this tremendous volume of water vapor must be removed or dissipated at the same rate in which it is being formed, otherwise it would be impossible to maintain the very high vacuum that is essential for the success of the process.

Within the past few years this and related engineering problems that have blocked the successful application of drying milk in the frozen state, have yielded to the experimental studies of the research staff of the Chain Belt Company. This has resulted in the development of the Freeze Drying process. In this process so high a vacuum is maintained in the drying chamber that dehydration is accomplished in an atmosphere essentially devoid of atmospheric air. The process yields a powder of exceptionally low moisture content and the oxygen content of the powder is sufficiently low to eliminate the necessity of vacuumizing the filled can. The process thus promises maximum resistance to fat oxidation and prolonged shelf life of dried whole milk and other dried milk products with relatively high butter fat content.

M3. Biochemical Changes in Whole Milk and Ice Cream Mix Powders During Storage.[1] N. P. TARASSUK AND E. L. JACK, Division of Dairy Industry, University of California, Davis, California.

The biochemical changes occurring in dry milk products during storage

[1] The subject matter of this paper has been undertaken in cooperation with the Quartermaster Corps Committee on Food Research.

affect the palatability, and thus the market quality, of these products. These changes are influenced by the processing treatments, the storage temperature, and the oxygen level in the package. Studies here presented show some of the effects of different conditions on the changes occurring in powders:

1. *Processing treatments.* Preheating temperatures are of major importance in retarding the deterioration of powders by staling. Powders made from milk preheated to 190–195° F. were consistently superior to powders made from milk preheated only to 165° F. This was particularly evident at room-temperature storage, whereas deterioration at 100° F. was sufficiently rapid to mask the effects of preheating. The effect of preheating was on the material associated with the fat because when the milk was separated and the skim portion preheated to 190–195° F. and the cream to lower temperatures no improvement was noted, while powder made from skim milk had excellent keeping quality whether preheated to either temperature.

2. *Storage temperature.* Observations were made at room temperature and 100° F. Atmospheric-packed samples had poor keeping quality at either temperature. When packed under low oxygen level—below two per cent—whole milk powder and ice cream mix powder were still acceptable after eleven months storage at either temperature. Slight staleness was noted. The rate of deterioration was greatest in the first three months of storage.

3. *Oxygen level.* Oxygen is the chief contributing factor to the development of stale flavor. Samples of whole milk powder packed with oxygen-absorbents, pyragallol and chromous chloride, to maintain the oxygen level as low as possible showed no deterioration in flavor at seven months. There was also no change in the composition of the headspace gas showing that no reactions occurred in the powders.

The source of stale flavor seems to be in the material associated with the fat because powder made from skim milk, whether packed in atmosphere or nitrogen, did not develop stale flavor, whereas powder made from buttermilk developed typical stale flavor.

The quantitative measurement of the changes accompanying deterioration of powders furnishes some ending as to the mechanism of the reactions involved. Analyses of the head-space gas show that production of carbon dioxide is a feature of deterioration. This gas is one of the final products of these changes. Amounts of carbon dioxide up to four per cent were produced in atmosphere-packed samples at 100° F., but at room temperature only up to 0.5 per cent, while samples packed with oxygen absorbents evolved practically no carbon dioxide. These may not represent absolute amounts of carbon dioxide because of the absorbing capacity of milk powders for this gas.

The reducing activity of powders increases in 100° F. storage, but is

slight or non-existent at room temperature. Samples packed in nitrogen showed greater reducing activity than air-packed samples. There was no relationship apparent between the reducing activity and the organoleptic score of the powder.

M4. The Role of Moisture and Oxygen Levels in the Changes Produced in Dry Ice Cream Mix in Storage. R. W. KUNKEL, S. T. COULTER, AND W. B. COMBS, Dairy Division, University of Minnesota.

Dry ice cream mix may undergo a number of changes in storage, including the development of tallowy and stale flavors, browning, production of carbon dioxide and water, utilization of oxygen, increase in reducing substances, in fluorescing materials (acetone, ether and 10 per cent potassium chloride extracts), in acidity and a decrease in solubility. Noticeably tallowy flavors do not develop in dry ice cream mix at oxygen levels below the Quartermaster Corps, Army Service Forces specification maximum of 3 per cent; however, stale flavors may develop even at oxygen levels as low as 0.5 per cent.

Samples of dry ice cream mix containing 1 to 3 per cent moisture, gas-packed at equilibrium oxygen levels of 0.5 to 3 per cent were stored at 100° F. (38° C.). The rate of flavor deterioration was accelerated by increases both in moisture and oxygen levels, but the effect of the moisture level was much the greater. Samples of dry ice cream mix ranging in moisture content from 2 to 4.5 per cent and gas-packed at equilibrium oxygen concentrations varying from 0.3 to 40 per cent were stored at 140° F. (60° C.). Under these conditions, the rates of increase in fluorescence, reducing substances, carbon dioxide, browning, and moisture, the decrease in pH and the loss of solubility, all were greatly accelerated by increase in the moisture level but were influenced very slightly—if at all—by changes in the oxygen level. Data at hand are not entirely adequate to establish the maximum moisture level desirable in ice cream mix, but this figure is not above 1 per cent.

M5. Factors Related to the Brown Discoloration of Powdered Whole Milk. W. A. KRIENKE AND P. H. TRACY, University of Illinois.

It has been observed that when dried whole milk is stored in steel barrels a few hours prior to packaging, as is done by some commercial companies, that a brown discoloration may take place if the powder is not cooled as it leaves the drier. To gain more information regarding this defect this study was made.

The experimental samples of powder were heated in Pyrex test tubes (1.5 × 15 cm.) in a temperature-controlled oil bath. Temperatures varying from 70° to 140° C. were used. The tubes were either left open, stoppered (with pressure relief tube) or were vacuated. Different moisture levels were obtained by exposing the powder to the atmosphere and to vacuation previ-

ous to heating. Gassed and ungassed samples were used for studying the significance of the oxygen content.

The data obtained show that discoloration of dried milk is related to: (1) The temperature and time of exposure of the powder. Discoloration was found to take place at all temperatures studied. In no case was it found possible to obtain the extent of discoloration in the test tube samples that was observed in the barreled powder when temperatures comparable to that of the powder as it reached the storage barrels were used. (2) Discoloration took place to a greater degree in the powder held in stoppered containers. The least discoloration took place in the samples vacuated during heating. (3) As the moisture content of the powder was decreased, the extent of browning became less. The effect of moisture was found to be very significant. (4) Differences in the discoloration of samples with varying oxygen levels were no more than would be expected from differences in moisture content as brought about by the vacuation.

Evidence was also obtained showing that both moisture and carbon dioxide were given off as a result of the browning reaction.

M6. Relative Keeping Qualities of Frozen Milk, Frozen Concentrated Milk, and Spray-Dried Whole Milk. J. H. Hetrick, W. A. Krienke, and P. H. Tracy, University of Illinois.

Studies have been conducted on the effects of ratio of concentration, addition of dextrose before freezing and method of freezing on the keeping quality of the products stored in a frozen state – 12 to – 15° F. in paper containers. Milk powders manufactured from the same lots of milk concentrated approximately 3–1 were air-packed and nitrogen-packed in tin containers and stored both at room temperature and at – 12° F. to – 15° F. Samples of each were analyzed initially for per cent of fat, per cent of total solids, acidity, reduced ascorbic acid, bacteria count, flavor and copper and iron content. At intervals during the storage period thawing observations, ascorbic acid and flavor scores were made on the thawed products; analyses of the headspace gas of nitrogen-packed powder were made and ascorbic acid and flavor scores were determined on the reconstituted powdered milk both air-packed and nitrogen-packed. In one experiment, sixteen periodic observations were made over a storage period of 523 days. A series of samples made from another lot of milk was stored 365 days and twelve periodic observations were made. A third experiment involving only frozen milk, frozen milk concentrated approximately 2–1, and frozen milk concentrated approximately 3–1 was performed in which observations were made throughout a 233 days storage period.

In general the frozen milk, and frozen concentrated milk possessed better keeping quality than even gas-packed whole milk powder made from the same lot of milk and stored at the same temperature. The flavor of the

frozen products remained satisfactory throughout the 523-day storage period, while the gas-packed whole milk powder stored at the same temperature became unsatisfactory after a storage period of 338 days. The air-pack powder stored at – 12° F. possessed a metallic flavor after 175 days. When powder was stored at room temperature an oxidized flavor was observed at 198 days in the nitrogen pack and at 105 days the air pack became unsatisfactory. There was some difference in the copper and iron content among these samples but the highest copper content did not exceed 1.5 micrograms copper per gram of solids.

All samples of frozen milk and frozen condensed milk showed no curdy, oily or flaky appearance on thawing when stored for 365 days at – 12 to – 15° F. One sample of milk concentrated 3–1 was satisfactory even after 523 days storage.

Ascorbic acid values on the thawed frozen products varied considerably but in general the retention of ascorbic acid in the frozen products compared favorably to that in gas-packed milk powder stored at the same temperature.

In the milk powder samples, greater ascorbic acid loss occurred in the air packs than nitrogen packs and more loss of ascorbic acid occurred in those stored at room temperature than in those stored at – 12° F.

Greater amounts of oxygen were present in the head space of gas-packed milk powders stored at – 12° F. than at room temperature.

The ratio of concentration (0 to approximately 3½–1), addition of dextrose prior to freezing or drying, the method of freezing (placing at – 12° F. vs. freezing initially in continuous ice cream freezer) did not prove to be important factors in flavor changes, or ascorbic acid retention, on thawing of the frozen products.

M7. Physico-Chemical Factors Affecting the Reconstitutability of Dry Whole Milk. G. H. Wilster, O. M. Schreiter, and P. H. Tracy, University of Illinois.

The problem has involved three phases: (1) Influence of manufacturing methods as affecting the reconstitutability, (2) method used for reconstituting, and (3) causes of film and scum deposit on containers used for reconstituted milk.

In these studies milk of highest standard consumer's grade and highest standard manufacturing grade was used. The equipment available for manufacturing the dry milk included: 200-gal. capacity stainless steel spray pasteurizer, 3-ft. diameter stainless steel vacuum pan, 200-gal.-per-hour two-stage homogenizer, 10-gal. capacity pre-heating tanks, 75-gal.-per-hour pressure pump for spraying, $6' \times 17' \times 9'$ drying chamber, and the necessary equipment for can sealing, evacuation and gassing of cans.

Typical defects of the reconstituted milk were: (1) Presence of undispersed powder particles which in some instances could be visibly observed

adhering to the wall of the container, (2) scum on surface of milk, (3) formation of distinct layers at top and bottom of container when this was left undisturbed for several hours in a refrigerator.

The film deposit on the container wall sometimes contained more and sometimes less fat in proportion to the total solids than the reconstituted milk.

Of the factors studied so far that have favorably influenced the reconstitutability were: (1) small powder particles and (2) the addition of a small amount of sodium citrate as a protein stabilizer to the condensed milk before spraying. The film deposit and scum have been reduced by: (1) manufacturing small particle-size powder, (2) spraying homogenized condensed milk containing minute, uniform-sized fat globules, (3) not overheating the powder in the drying chamber.

The factors that have favorably influenced the completeness of the dispersion of the dry milk particles in the water used for reconstituting were: (1) Using warm, 110° F., water instead of water at 75° F. or lower, (2) heating the dry milk–water mixture to a temperature of 150° F., (3) homogenization of the reconstituted milk at a temperature of 75° F. and a pressure of 1,000 to 2,000 pounds per square inch, (4) passing the reconstituted milk through a clarifier, (5) using a high-speed electric agitator when reconstituting, and (6) the addition of a small amount of sodium citrate to the water used for reconstituting.

The results have shown that, to produce reconstituted dry whole milk which compares favorably with fresh, homogenized milk in physical condition, when water at 75° F. and an electric malted milk mixer are used when reconstituting, the condensed milk sprayed must contain the fat globules in a finely dispersed form, the powder particles must be uniformly small and overheating during drying must be avoided.

M8. Changes in the Fluorescence of Dry Whole Milk on Storage. R. JENNESS, S. T. COULTER, AND R. LARSON, University of Minnesota.

The production of fluorescing and brown-colored substances in dried milk during storage has been studied because such substances appear to be formed under conditions that favor stale flavor deteriorations, and it was hoped that the intensity of fluorescence or of brown color might serve as an objective index of the extent of stale flavor development.

A method has been devised whereby the fluorescing materials are divided among three successive extracts of the reconstituted dry milk as follows: I—acetone-water (67 : 33); II—acetone-ether (20 : 80); and III—10% KCl. Fluorescence of each extract was determined with the Coleman Photofluorometer using filters B–1 and PC–1, the instrument being standardized with a quinine sulfate solution. Riboflavin can be determined independently in extract I using filters B–2 and PC–2.

Upon storage of dry whole milk the fluorescence of extracts I and III increased while that of extract II was not consistently altered. The development of fluorescence (and of brown color) can be greatly accelerated by increasing the moisture content of the powder or the temperature at which it is aged. Furthermore, there is a certain degree of parallelism between the rates of development of stale flavor and of fluorescence. The oxygen level during storage appears not to be related to the development of fluorescing and brown materials.

The analytical scheme outlined has been further applied to several series of simplified systems of systematically varied composition in order to ascertain which of the milk constituents are responsible for (1) the initial fluorescence and (2) the fluorescence developed in storage. It appears in fresh samples that riboflavin is responsible for about 50% of the fluorescence of extract I, the remainder being extracted from the various protein constituents. The lipides account for most of the fluorescence of extract II while the proteins contribute to that of extract III.

Upon storage the increases in fluorescence of extract I appear to involve the proteins, lactose and riboflavin, while those in extract III are associated with the proteins and lactose.

M9. Changes in Reducing Materials in Dry Whole Milk During Storage.
L. K. Crowe, S. T. Coulter, and R. Jenness, University of Minnesota.

The effect of storage of dry whole milk at 60° C. on the production of materials which reduce 2,6-dichloro-phenol-indophenol and potassium ferricyanide under specific conditions has been studied.

Materials which reduce ferricyanide increase during storage.

Moisture is important in the reaction which produces materials which reduce ferricyanide. The rate of the reaction in low-moisture powders does not appear to be greatly influenced by the oxygen level.

Reduction of indophenol by materials in the protein-free filtrates from whole milk powders indicates an apparent destruction of ascorbic acid in air-packed powders at all moisture levels studied.

The slight increase in indophenol titre of samples stored at 60° C. for periods of time up to 192 hours may probably be attributed to the production of indophenol-reducing materials which remain in the protein-free filtrate.

M10. Drying Milk in an Atmosphere of Nitrogen or Carbon Dioxide.
S. T. Coulter, Dairy Division, University of Minnesota.

The use of a gas such as nitrogen or carbon dioxide in spray-drying has been demonstrated to be feasible. Dehumidification of the gas for recirculation can be accomplished by cooling to 70° F. Cooling can be effected by

a suitable water coil using about 50 gallons per minute of 50° F. water per 1000 C.F.M. of nitrogen. Obviously the spray-drying system must be reasonably gas-tight.

The principal advantage of drying in an atmosphere of an inert gas is the ease with which extremely low oxygen levels in the canned powder can be reached. Based on the results of numerous trials, air-dried powder gas-packed to an equivalent oxygen level has essentially the same keeping quality as the product dried in a gas of low oxygen content. With the experimental drier at the University of Minnesota, it has been possible to dry and can milk in gas containing less than 0.5 per cent oxygen. To gas-pack air-dried powder to this oxygen level requires triple or quadruple gassing.

M11. Relation of the Temperature of Separation and the Heat Treatment Given the Skim Milk to the Keeping Quality of Spray-Dried Ice Cream Mix. HARRY PYENSON AND P. H. TRACY, Department of Dairy Husbandry, University of Illinois, Urbana, Illinois.

Twelve batches of dried ice cream mix were made from the same lot of milk. The milk was separated at 55° and 130° F. The skim milk was divided into two lots and forewarmed at 150° F. for 20 minutes and 180° F. for 5 minutes, and condensed in a stainless steel vacuum pan. Some of the cream was made into butter and some was made into butter oil. Dried ice cream mixes were made from these ingredients so that the relation of the heat treatment given the serum solids to the keeping quality could be studied.

The carbon dioxide content of the headspace gas varied throughout the storage period. Oxygen concentration gradually became lower as the storage period advanced. There was a tendency toward more rapid oxygen absorption, more carbon dioxide evolved, and more oxidized flavor development in mixes that had the condensed skim milk forewarmed at 150° F. for 20 minutes than in those mixes that had the condensed skim milk forewarmed at 180° F. for 5 minutes. There seemed to be no significant difference in oxidized flavor development when the mixes were prepared from concentrated skim milk made from skim milk separated at 55° or 130° F. Whether the fat used was in the form of cream, butter or butter oil was not a factor influencing the keeping quality of the dried ice cream mix. All the batches became oxidized which contained butter oil, butter or cream which were made with skim milk forewarmed at 150° F. for 20 minutes. After one year dried mixes made from skim milk forewarmed at 180° F. for 5 minutes had not developed an oxidized flavor and were still highly palatable.

High forewarming temperature on the skim milk before condensing is beneficial in prolonging the keeping qualities of dried ice cream mixes and the retardation of oxidized flavor development.

SYMPOSIUM

Summary of Quality Symposium. H. F. JUDKINS, *Chairman.* Panel Members: G. M. TROUT, C. V. CHRISTIANSEN, A. C. DAHLBERG, E. C. SCOTT, R. V. HUSSONG, G. W. SHADWICK, W. V. PRICE, H. L. WILSON, P. H. TRACY, O. F. GARRETT.

In Mr. Judkins' remarks opening the Symposium, he pointed out that in this seller's market era, interest in quality was inclined to lag and that a Quality Symposium, therefore, seemed very timely. It was stated that certain minimum facilities must be available and that these facilities must be properly used by quality-minded individuals if a quality product is to be maintained. Emphasis was placed on the importance of university instruction in teaching students the best minimum facilities for various dairy operations and the art of teaching proper methods in the use of these facilities. It was suggested that a course might well be given covering product defects, their causes and prevention, in order to train students in the fundamentals of "diagnosing quality disease."

Examples were given relating to the effect of improper equipment or lack of equipment to quality.

It was pointed out that only high quality raw materials can be used, shortage or no shortage.

In conclusion, Mr. Judkins stated that if management wants quality and is as interested in studying quality reports as they are profit and loss statements, they will have quality.

The different members of the panel had been asked to submit a series of questions and answers in advance to Mr. Judkins. Prior to the Symposium, these had been arranged in the form of a radio script so that the Chairman could ask related questions about the quality of the different products and these were answered by members of the panel. These questions and answers were interspersed with frequent questions and discussion from the audience. Space will not permit a detailed report on the questions and answers. The following are some of the conclusions which were developed:

1. Standards for quality are mainly determined by the results of research on the part of those who are students of quality. Regulatory bodies set their standards based on such research.
2. The consumer's part in determining product quality is principally in judging whether or not the standards established by the expert suit their senses of sight and taste. This consumer judgment is reflected principally in the sales curve for the product and to a much lesser degree in quality complaints.
3. Quality complaints are relatively few and this fact is a deterrent to progress in quality improvement.
4. The quality control supervisor has two main functions; first, to maintain uniformity of quality from day to day, and secondly, to constantly raise the level of quality for a product. For the immediate

success of the business, the first is extremely important, but for the long pull, the second may be equally as important.

5. It was agreed that the ADSA score cards for products were helpful in appraising quality and in gradually arriving at a more uniform standard of quality throughout the country.

Interest in the Symposium seemed to be very good indeed, and it was generally agreed that a Symposium of this type might well constitute a part of the program of future meetings.

CHEESE AND EVAPORATED MILK

M12. The Gas Packing of American Cheddar Cheese. N. S. GOLDING, J. N. REYNOLDS, AND C. C. PROUTY, State College of Washington.

The canning of cheese either in valve vent cans or vacuum packed has been under investigation for a number of years. This paper considers gas packing of degassed cheese with either CO_2 or N_2. Standard conditions for weight of cheese and space in the can were maintained in all experiments. 2041 grams of cheese known to produce little or no gas during ripening were sealed in No. 10 five-inch cans with a 1-mm. opening or a $\frac{1}{8}$-inch tinned copper side arm to which a pressure rubber tube could be attached.

The cheeses were then degassed in desiccators for various lengths of time at room temperature and at an absolute pressure of from 20 to 30 mm. of Hg. Following degassing, CO_2 or N_2 was rapidly filled into the desiccator returning it and the can to atmospheric pressure. The opening in the can was immediately sealed by soldering or the tube closed with a pinch clamp. The loss in weight due to degassing even up to 72 hours was insignificant. Subsequent changes of pressure in the can of cheese were then measured on a Hg manometer or by a pressure can tester.

With CO_2 gassing a pressure equilibrium was reached in about four days. Cheese degassed for 1 hr., 24, 48, and 72 hrs. had a vacuum in the cans of 355, 390, 394, and 401 mm. of Hg, respectively. Cheeses of the same batch and weight cut into $\frac{1}{8}''$ slices and degassed for 24 hours reached a pressure equilibrium much sooner and had a vacuum of 465 mm. of Hg. Reducing the space in the can by using more cheese increased the ultimate vacuum. When N_2 was used to gas the cheese subsequent to similar degassing only a slight vacuum was produced in the can of cheese.

M13. The Action of the Associate Starter Organisms in American Cheddar Cheese. C. C. PROUTY AND N. S. GOLDING, State College of Washington.

Cheese starters as they are commonly used are not pure cultures of lactic-acid-producing bacteria. Rather they are mixed cultures, containing in addition to the lactic-acid-producing organisms the so-called associate types *S. citrovorus* and *S. paracitrovorus*.

Since these organisms are capable of producing CO_2 a study was planned to determine the extent of the vacuum changes occurring during the ripening process of vacuum-packed American cheddar cheese to which known quantities of either *S. citrovorus* or *S. paracitrovorus* or both were used in conjunction with either *S. lactis* or *L. bulgaricus* or both in the cheese starter.

Cheese in which the starter consisted of *S. lactis* or *L. bulgaricus* alone or in combination showed little vacuum loss at ripening temperatures of either 45° or 55° F. over periods ranging up to six months, whereas when *S. citrovorus* or *S. paracitrovorus* were used in conjunction with the lactic-acid-producing starter organisms a greater loss of vacuum occurred, more loss being associated with the use of *S. paracitrovorus* than with *S. citrovorus*.

M14. Studies on the Resistance of Various Cheese Cultures to the Action of Bacteriophage. F. J. BABEL, Dairy Industry Department, Iowa State College.

In an attempt to eliminate slow acid production due to bacteriophage during the manufacture of cheese, a system of culture rotation was practiced. This rotation included six cultures which were being carried in the regular culture collection in the Dairy Department of Iowa State College and one culture obtained from a creamery organization. None of the seven cultures were sensitive to the bacteriophage strains which had been responsible previously for slow acid production during the manufacture of cheese. The rotation was arranged so that the same culture would not be used more than one day per week. This arrangement was quite satisfactory for one week. During the second week, four of the seven cultures produced acid slowly due to the appearance of bacteriophage active against these cultures. In the third week, all of the cultures were slow and bacteria-free filtrates active against all of the cultures were obtained from samples of whey.

When slow acid production during cheese manufacture was first encountered, the bacteria-free filtrates prepared from the whey, obtained from vats in which acid production was slow, were active only against the culture being employed at that time. Also, when the system of culture rotation was first practiced, the bacteria-free filtrates containing bacteriophage were active only against the culture employed in the cheese-making operation. During the second and third weeks in which the system of culture rotation was practiced, bacteria-free whey filtrates active against two or more cultures were obtained. Bacteria-free filtrates prepared from single plaque isolations of bacteriophage were active also against one or more cultures.

Several cultures of *Streptococcus lactis* isolated from sour cream and sour milk were not sensitive to any of the bacteria-free filtrates containing bacteriophage which were responsible for previous instances of slow-acid production. One culture of *S. lactis* (W4) isolated from sour cream was used in the cheese laboratory for approximately 3 months before it was

attacked by bacteriophage. Another culture of *S. lactis* (W8) obtained from the same sample of cream as culture W4 was sensitive to the bacteria-free filtrate prepared from the whey in the vat in which culture W4 was used. A culture of *S. lactis* obtained from sour milk was used in the cheese laboratory for 5 months; at the end of this time the culture was still very satisfactory but was discontinued in order to study certain other cultures.

The use of *S. lactis* cultures isolated from certain natural sources appear to be an immediate solution to the bacteriophage problem in cheese plants experiencing difficulty with slow acid production.

M15. The Influence of the Quality of Milk and the Curing Temperature on the Ripening of Pasteurized-Milk Cheddar Cheese. GEORGE P. SANDERS, HOMER E. WALTER, AND RALPH P. TITTSLER, Division of Dairy Research Laboratories, Bureau of Dairy Industry, Agricultural Research Administration, U. S. Department of Agriculture.

Quality-improvement experiments, including ripening studies, were conducted on approximately 260 vats of Cheddar cheese cured at different temperatures from 40° to 70° F. Among these, 18 lots of cheese were made by the time-schedule method from raw and pasteurized portions of milks of good, fair, poor, and very poor quality. Samples from separate daisy-size cheeses, cured at different temperatures, were graded at definite ages and tested also to determine their chemical, bacteriological, and physical properties.

In making cheese from pasteurized milk by the time-schedule method, it was comparatively easy to control the acidity within a range favorable for the production of the best cheese—*e.g.*, titratable acidity of whey 0.45 to 0.50 per cent, pH of curd 5.35 to 5.40, at milling. It was much more difficult to control the acidity in making cheese from raw milk, especially with low-grade milk, and excessive acidity during making and ripening was commonly associated with poor quality of cheese.

The quality of the milk and the curing temperature had much greater effects, on the rate of ripening and on flavor, than did pasteurization. When the cheese was made from high-grade milk, pasteurization had little effect on either the rate of ripening or the rate of development of flavor. Proteolysis was much more rapid in raw-milk cheese made from poor milk than in that made from good milk. The extent of proteolysis in cheese cured at 50° F. for 6 months (*e.g.*, approximately 30 per cent of the nitrogen soluble) was comparable with that in cheese cured at 60° for 3½ months.

The cheese made by the time-schedule method from pasteurized milk was consistently better and more uniform in quality than that made from raw milk, except when very high-grade milk was used. The improvement in the quality of the cheese resulting from pasteurization was greatest when

medium-grade and low-grade milk, especially the latter, was used. Proper pasteurization suppressed completely the defect of gassiness.

The cheese made by the time-schedule method from high-grade, pasteurized milk and cured at 60° F. developed not only more but also better flavor than the control cheese cured at 50° or lower. On the other hand, when low-grade milk was used, either raw or pasteurized, the quality of the cheese cured at 60° was inferior to that of the cheese cured at 50°, and this inferior quality was especially pronounced when the low-grade milk was not pasteurized. A curing temperature of 70° was found to be too high even when high-grade milk was used.

M16. A Grating Type Cheese. G. H. Watrous, Jr., and C. D. Dahle, Pennsylvania State College.

Imports of highly flavored, dry cheese of the Parmesan type have been drastically curtailed. Prior to the war, Italy was the main supplier of this type of cheese, so popularly used with spaghetti, soups, and in many foods as a condiment.

The characteristic flavor of some types of grating cheese, imported or domestic, is of free fatty acid similar to butyric acid. In the imported cheese, the characteristic flavor as well as the hard dry body is obtained only after curing from one to three years.

The authors conceived the idea that a type of cheese suitable for grating could be obtained in a much shorter time by forcing the development of the fatty acid flavor by means of homogenization.

It was found that a good, characteristic flavor, body and texture could be obtained from raw skimmed milk which had been standardized to two per cent fat with homogenized pasteurized cream. The lipase in the raw skimmed milk produced the free fatty acid from the fat of the homogenized pasteurized cream.

Control lots were made using rennet paste, but very little flavor developed within a year, while the cheese made from raw skimmed milk and homogenized pasteurized cream had a good flavor in five months and an excellent flavor and body in seven months.

M17. The Influence of Age and Degree of Ripeness on the Activity of Cheese Cultures. H. C. Olson and Russell Beachboard, Oklahoma Agricultural Experiment Station, Stillwater, Oklahoma.

Ripened cheese cultures held at 40° F. and 50° F. showed no significant decreases in activity during storage for five days; the cultures were removed from storage, inoculated into pasteurized milk, and the rate of acid production at 86° F. determined. These cultures showed marked decreases in activity when held beyond five to seven days. The cultures held at 32° F. and below freezing (0° F. to – 10° F.) showed marked decreases in activity dur-

ing storage. When the cultures which had been stored at the various temperatures for different periods were removed and run through one intermediate transfer in milk at 70° F. for sixteen hours before determining their activities, they were much more active than when the original stored cultures were inoculated directly into the milk. When this intermediate transfer was employed there were no significant differences in the activities of the cultures stored at 32° F., 40° F. and 50° F. during the first five days, but beyond five days the influence of age in slowing up the cultures was apparent. The cultures which had been held frozen and then passed through an intermediate transfer still reflected the influence of the damaging effect of the freezing.

The degree of ripeness of the culture at the time of inoculation into cheese milk apparently has no significant influence on the activity of the culture, providing the culture was firmly coagulated at the time of its use. Ripening for several hours beyond the usual ripening period appeared to have no detrimental effect on the activity of the culture. Our results indicate that for best results the cheese culture should be freshly prepared and thoroughly ripe.

M18. A Study of the Physical Changes Which Affect the Storage Life of Evaporated Milk. B. H. Webb, E. F. Deysher, and C. F. Hufnagel, Division of Dairy Research Laboratories, Bureau of Dairy Industry, Agricultural Research Administration, U. S. Department of Agriculture.

Important changes which sometimes occur during prolonged storage of evaporated milk include a separation of fat, of protein, and of insoluble salt crystals, as well as a darkening in color. Many factors control the magnitude of these changes, including conditions of manufacture and of storage. Most commercial evaporated milks remain in a good physical state after 2 to 3 years' storage under favorable conditions. Occasionally some undesirable changes occur after storage for 6 months or longer and these are more pronounced under adverse storage conditions.

The viscosity of all evaporated milks dropped to a basic level during storage. The relationship between the time required for a milk to thin to such a level and the storage temperature was logarithmic with respect to time. The magnitude of the change in viscosity during storage varied for different milks. A stable high-grade milk with an initial viscosity of 55 centipoises had a viscosity of 27 centipoises after 200 days' storage at 86° F. One of the poorer milks held under the same conditions dropped from 66 to 16 centipoises.

There was a tendency for the protein of some evaporated milks to settle to the bottom of the can during storage. This protein separation was more pronounced in evaporated skim than in evaporated whole milk. Homogenization retarded protein separation in evaporated whole milk. The results

indicated that the fat in evaporated milk was very important in helping to maintain a normal dispersion of milk constituents throughout the can during long storage periods. The buoying tendency of the fat seemed to counterbalance the settling tendency of the protein.

The size of the fat globules in evaporated milk as measured by the Farrall Homogenization Index gave an indication of the fat separation which could be expected in poorly homogenized milks of known viscosities.

A linear relationship existed between the time and temperature of sterilization of evaporated milk in respect to the development of color over the temperature range 225° to 255° F. The amount of color that developed during the storage of evaporated milk at various temperatures was logarithmic with respect to time.

Analysis of the small hard crystals which formed in some samples of evaporated milk after storage for 2 to 3 years showed the crystals to be largely calcium citrate. When milks were seeded with calcium citrate or when solutions of calcium chloride and sodium citrate were added to milks before sterilization, the growth of crystals during storage was accelerated.

M19. Observations on the Judgment of Flavor Defects in Dairy Products. D. V. JOSEPHSON, Department of Dairy Technology, Ohio State University.

In the training of students and in the selection of tasting panels for scoring dairy products, little consideration has been given to the determination of the individual taste patterns of the judges and their abilities to detect and evaluate flavor defects. Individuals vary widely in their abilities for detecting basic flavor qualities as well as deteriorative defects in dairy products.

A study connected with five trained observers (three of whom had judged dairy products for 15 to 25 years) demonstrated that each individual has a definite taste pattern which is rather constant from day to day. However, an observer, who is sensitive to certain taste qualities, may require relatively high intensities of others to give consistent reports.

Working with U.S.P. lactose in varying volume-molar concentrations the five observers demonstrated taste thresholds (points or ranges where significant reports of "sweet" were given) of 0.05 to more than 0.133 volume-molar. In other words, one observer consistently detected a sweet quality in a solution containing 1.8 grams of lactose per liter, while another required in excess of 48 grams per liter. The addition of 0.15 per cent salt (NaCl) to a solution containing 4.8 per cent lactose (normal concentration for milk) intensified the sweet quality of the solution remarkably. One observer, who could not detect sweet in a 4.8 per cent lactose solution, consistently reported "sweet" when the salt was present. Another observer consistently reported "salt-followed-by-sweet" for such a solution. This observer later demonstrated an extremely low threshold for salt. Salt

(NaCl) threshold values for the five observers varied from 0.0025 to 0.02125 volume-molar, and those most capable in detecting salt were the least capable of detecting the sweet quality of lactose. Dilute solutions of salt (below threshold level) were usually sweet to most observers while lactose was frequently bitter or sour at such levels. At certain concentrations salt solutions tasted "salty" to some observers while others consistently reported "sweet" or "flat" on the same solution. Similar relationships exist in the detection of "cooked," "oxidized," "rancid," "salty," and other defects in milk. For example, carefully controlled experiments where the factors of size of sample, temperature of sample, and interval between samples were controlled, one judge consistently described a flavor defect as "pronounced," another described it as "slight," while another could detect no off-flavor. An observer most sensitive to one flavor defect was frequently least capable of detecting another.

The tactual taste qualities (from touch response of tongue and mucous membranes) were found to be of extreme importance in certain dairy products. In powdered milks, tactual flavor qualities are very prominent and are described as "powdery," "chalky," "rough," "astringent," or "puckery." On a given sample of re-constituted powdered milk, the five observers varied in their description of the sample depending upon the sensitivity of their tactual responses. Some observers were extremely sensitive to the tactual quality and described it as "puckery" or "astringent" while others, who were less sensitive to it, reported "chalky" or "powdery." Very fresh milk powders and old milk powders appeared to exhibit the most prominent tactual qualities. Evaporated milk exhibited similar but more intense tactual flavor qualities. Although insufficient evidence is available at this time, it is probable that sulfides or other protein degradation products, or a combination of these with lactose degradation products are responsible for this defect in powdered and evaporated milks.

Because of the great variation among observers in their abilities to detect and evaluate flavor qualities and defects, it would appear that greater care might be taken in setting up judging panels for tasting experimental samples and in the training of students in the grading of dairy products. Furthermore, a more standardized system of terminology and score should be adopted, particularly for milk. The present scoring ranges applied to milk flavors are far too wide to permit uniform judging even among trained and experienced judges.

BACTERIOLOGY AND CHEMISTRY

M20. A Water-Soluble Antioxidant for Milk and Milk Products. N. P. TARASSUK AND J. L. HENDERSON, University of California, Davis, California.

During the last four years an increasing emphasis has been placed on

antioxidants for preservation of fats, oils and fat-containing foods from oxidative deterioration. Milk, cream, whole milk powder and other milk products are subject to either spontaneous or the copper-induced oxidized flavor. In winter when cows are fed dry feed, certain cows produce milk highly susceptible to oxidation and the milk and cream will develop an oxidized flavor on the second or third day in spite of good processing practices. The use of a suitable antioxidant offers a practical solution in these instances.

To be used in a dairy product, an antioxidant must be entirely innocuous, impart no color, flavor or odor to the product, remain stable during processing treatments, and it should be sufficiently soluble in the product to make its incorporation uniform and easy. The last requirement necessitates that an antioxidant for milk must be water-soluble because the use of other solvents, say alcohol or acetone, would be neither safe nor practical. The better-known antioxidants at the present are not water-soluble.

In 1943 the authors reported in the paper entitled "Vitamin-B-Complex Preparations as Antioxidants in Milk and Milk Products" that the source of antioxygenic activity of these preparations resides not in the known crystalline B vitamins but in the materials used as "carriers," flavoring materials, or the concentrates from natural sources which contain certain vitamins. This material was fractionated by means of various solvents and the fractions obtained were tested for the antioxygenic activity. Two groups of compounds were isolated as possessing antioxygenic activity and identified: 1. The tannins; 2. The flavones. Both groups are widely distributed in many species of plants used for animal-human consumption. The flavones are naturally occurring plant pigments responsible for a yellow color of many flowering plants and are commonly found in citrus fruits. Tannins are present in many food plants, such as, asparagus, sweet almonds, linseed, caraway seeds, plums, other fruits and coffee. Tea contains on an average of twelve per cent tannin.

Experiments with C.P. tannic acid and quercetin (tetrahydroxy flavone) have shown them both to be effective in prevention of the development of either spontaneous or the copper-induced oxidized flavor in milk and cream when they were added in a concentration as low as 0.0025%. Addition of 0.01% of either material prevented the development of oxidized flavor in milk susceptible to "spontaneous" oxidation to which 5 p.p.m. of Cu^{++} had also been added.

Incorporation of quercetin in milk is difficult since it is not water-soluble. Tannic acid, on the other hand, is water-soluble. Its incorporation in milk or cream is easy and simple. Small amounts that are required can be dissolved in few ml. of water or added directly to milk or cream. Tannic acid, even when added in the amount several times as great as necessary, does not impart any flavor foreign to the milk. The wooden musty odor of tannic

acid which occurs in some commercial lots is removed entirely by heating water solution of tannic acid to boiling before it is used. Addition of tannic acid to milk in concentration of 0.005% or higher before drying prevents the oxidative deterioration of milk powder. Tannic acid was found to be also a very effective antioxidant for milk fat, lard and other animal fats when added to these products in concentration of 0.01% or higher. Glycerol can be used as a solvent for incorporating tannic acid in fats and oils. The water extract of tea has greater antioxygenic activity in milk than can be accounted on tannin basis. An addition of 0.20% by volume of the 5% aqueous extract of tea was sufficient to prevent the development of oxidized flavor in milk to which 0.5 p.p.m. of Cu^{++} was added.

Patent applications have been filed, Serial No. 542, 596 and No. 542, 597, June, 1944, for the use of tannic acid and quercetin in milk and milk products and tannic acid in animal fats.

M21. Isolation of Whey Proteins and Their Conversion into Food Products. L. A. BURKEY AND H. E. WALTER, Division of Dairy Research Laboratories, Bureau of Dairy Industry, Agricultural Research Administration, U. S. Department of Agriculture.

Only one-fourth of the whey resulting from cheese-making in the United States is utilized as human food. The remaining 7 billion pounds of whey, which contains 70 million pounds of protein of high nutritional value for humans, is utilized as feed for animals or is wasted.

The increased demand for food during the war, followed by the great need for providing additional sources of food at the present time, has focused attention on methods for conserving this highly nutritional protein.

Our research has resulted in improved methods for recovery of whey proteins, which are readily adaptable for use in any cheese factory. These methods consist of heating the sweet whey (after adjustment when necessary to pH 6.4 or to a titratable acidity of between 0.11 to 0.14 per cent lactic acid) to near boiling temperature by means of a steam injector heater; precipitation of the proteins by the addition of sour whey or acid to lower the pH of the heated whey, preferably to between 4.8 and 5.3; and recovering the protein curd by dipping, as in making Swiss cheese, or by draining off the whey filtrate as is the practice in making Cheddar cheese.

The protein curd obtained from Cheddar cheese whey is likely to be firmer and more grainy than that obtained from Swiss cheese whey. Precipitation at temperatures above 205° F. likewise yields a firmer, more grainy-textured curd. On the other hand recovery of the precipitated protein is more difficult when precipitation occurs below 200° and when too much agitation is used during the precipitation process.

After complete drainage of the whey, the protein curd has a pleasant but not a pronounced flavor; the acidity is between pH 5.6 and 6.0; it

contains about 75 per cent moisture, 16 per cent protein, and 2.5 per cent fat; it is slightly grainy but mats well so that it can be milled and pressed in hoops as is Cheddar cheese curd; and it is practically sterile but mold and bacteria grow well on it.

Studies have been carried out in the conversion of the protein curd into cured cheese, cottage and cream cheese, and cheese spreads. *Penicillium roquefortii* brings about a rapid break-down of the curd when it is used in making a Roquefort-type cheese. This curd has shown promise also when made into a cottage cheese. The grainy texture of the curd interferes to some extent with its use in the making of cream cheese and cheese spreads.

M22. Variations in the Acid Degree of Milk Fat as Affected by Churning and Extraction Procedures. B. C. JOHNSON AND I. A. GOULD, Maryland Agricultural Experiment Station.

Since preliminary studies indicated that the free acid content of fat was higher when the fat was obtained from cream by solvent extraction than when it was obtained by churning, additional experiments were conducted to study this relationship more thoroughly and to determine the applicability and reliability of the respective methods. One phase of the study consisted of developing a suitable extraction procedure. In this investigation, various proportions of the solvents; *i.e.*, ethyl ether and Skellysolve F, were used to determine the most satisfactory ratio. The procedure adopted was as follows: Rancid cream was produced by homogenizing raw cream of 30–32 per cent fat, holding several hours and then heating to 145–150° F. for 10 minutes to inactivate the lipase. One hundred twenty-five grams of this cream were shaken for 15 seconds with 100 ml. of ethyl alcohol and allowed to stand 5 minutes. To this mixture was added a total of 200 ml. of the extractants, the ratio of ethyl ether to Skellysolve varying as follows: 4 : 0, 3 : 1, 1 : 1, 1 : 3, and 0 : 4. In one series of trials, the respective solvents were combined prior to their addition to the sample and this mixture was incorporated into the sample by a shaking period of 30 seconds. In another series, the solvents were added separately to the cream-alcohol sample with 15 seconds shaking after each addition. Following the addition of the solvents, the mixture was centrifuged for 3 minutes at approximately 1500 r.p.m., the supernatant ethereal portion removed by syphon and the solvent evaporated. Portions of the same cream used for solvent extraction were also churned according to standard procedure. Free fatty acid content of the fat was determined by titration of a 10-gm. sample with N/10 NaOH to the phenolphthalein endpoint.

The resulting data reveal that the most satisfactory ratio of ethyl ether to Skellysolve was approximately 1 : 1 but that this proportion may be varied to some extent. Slightly higher and more uniform titration values resulted when the solvents were mixed before being added to the cream than

when they were added separately. When the ratio of the ether to the Skellysolve was 1:1, the solvent extracted fat averaged about 30 per cent higher in titration value than did the churned fat although this varied somewhat with the individual trials.

Studies were also made to determine the effect of such factors as the presence of formalin and lactic acid in the cream on the free acid content of the fat obtained by the extraction and churned methods. When formalin was added at the rate of 1 ml. per pound of cream it was found to reduce the efficiency of fat recovery both by extraction and by churning, and to result in a titration increase of about 8 per cent in the churned fat. The addition of 0.2–0.3 per cent of lactic acid to the cream resulted in appreciably higher titers of both extracted and churned fats: the extracted fat increasing about 4 per cent and the churned fat about 27 per cent in comparison to the control.

Applications made of the extraction procedure indicate that it may possess definite advantages over the churning method for measuring the degree of fat splitting which results from lipase activity.

M23. Concentration of the Free Fatty Acid Portion of Milk Fat by Alcohol Extraction. I. A. GOULD, Maryland Agricultural Experiment Station.

In studies conducted to ascertain the specific changes which occur in milk fat as a result of lipase action, steps were taken to concentrate the free fatty acid portion of the fat by means of hot ethyl alcohol extraction, and then to determine the fat characteristics of this alcohol-soluble fraction. Although several procedures were attempted, the one finally adopted was as follows: Butter-oil was heated to boiling in approximately twice its volume of ethanol, the mixture centrifuged, and the supernatant liquid largely removed by siphoning. This treatment with hot ethanol was repeated twice and the three lots combined. The alcohol extract was cooled overnight at 32–35° F. and the small quantity of white precipitate was removed by filtration. This white precipitate contained no appreciable acidity. The alcohol in the clear filtrate was then removed by heating under a partial vacuum, the fat taken up in ether and Skellysolve F and the solvent removed under partial vacuum. The final extract was liquid at room temperature, golden yellow in color, and contained more than 90 per cent of the free fatty acids of the original fat. The extract from non-rancid fat was practically devoid of any rancid flavor whereas the extract from the rancid fat possessed a pungent bitter flavor. The yield of extract averaged 7.8 g./100 g. of non-rancid fat and 20.2 g./100 g. of rancid fat. On the basis of preliminary trials and when compared to the original fat, the extracted material from non-rancid fat exhibited the following approximate changes: a nine-fold increase in acid degree, a two-fold increase in Reichert-Meissl and Polenske numbers and in soluble acids, a 10 per cent increase in the saponification and in the

iodine numbers, a 10 per cent decrease in the non-soluble acids, and a slight decrease in the refractive index.

The extract obtained from rancid fat exhibited values comparable to those of the extract from non-rancid fat, but showed somewhat smaller increases in acid degree, in Reichert-Meissl and Polenske numbers, and in the soluble acids when compared to the original fat. The data obtained from these preliminary trials by the alcohol extraction procedure do not permit a clear differentiation between rancid and non-rancid fat on the basis of the fat characteristics of the resulting extracts nor an identification of the specific fatty acids involved in lipolysis.

M24. The Direct Microscopic Count as a Method for Counting Bacteria in Pasteurized Milk. M. P. BAKER, Iowa State College, Ames, Iowa.

Studies were made of the effect of pasteurization on the staining of bacteria in milk by the direct microscopic technic. Raw milks with low initial bacterial counts were inoculated from skimmed milk cultures of types of bacteria commonly found in milk. The cultures from which these were taken were incubated at 20° and 37° C. and for 24, 48 and 72 hours respectively to observe the effect of temperature of growth and age of culture. Direct microscopic counts were made on the raw milks immediately after addition of the bacteria and again immediately after pasteurization and cooling, pasteurization being at 143° F. for 30 minutes. The pasteurized samples were then held for 72 hours at approximately 3° C. and direct counts made at 24-hour intervals to determine if there were any changes in the ability of the cells to stain. Organisms used included *Streptococcus lactis, Streptococcus durans,* several strains of micrococci, several strains of aerobic spore formers, *Lactobacillus casei, Pseudomonas putrefaciens* and *Alcaligenes viscosus.*

The pasteurized milk counts expressed as per cent of the companion raw milk counts varied considerably with all types of organisms studied. When *S. durans* was used as the test organism the pasteurized counts averaged almost as high as the raw milk counts. There were some noticeable exceptions, however, and in some trials the counts were much lower after pasteurization. This was true with the micrococci also. With *S. lactis* generally a somewhat lower percentage of the cells stained after pasteurization, in the majority of the comparisons the pasteurized milk counts being less than 60 per cent of the raw milk counts. The other organisms studied stained noticeably poorer and the *Ps. putrefaciens* showed especially poor staining qualities after pasteurization.

The results of these studies indicate that the direct microscopic count on pasteurized milk may or may not be equal to a similar count on the same milk before pasteurization. In some instances it may be only a small frac-

tion of what the direct count on raw milk had been. These differences apparently depend on the types of bacteria present in the milk, on errors in technic and on other factors not indicated by the data obtained.

M25. Non-Lactose Fermenting Yeasts and Yeast-Like Fungi from Cream and Butter. STANLEY H. F. CHINN AND F. E. NELSON, Iowa State College.

Three hundred and sixty-nine yeasts and yeast-like fungi were isolated from 124 samples of cream and 203 samples of butter. Of the 342 cultures which were unable to ferment lactose, 3 were species of *Saccharomyces,* 41 of *Rhodotorula,* 9 of *Pullularia* (tentative), 81 of *Torulopsis,* 11 of *Trichosporon,* and 197 of *Candida.* Twenty-eight types were recognized of which 14 could be identified quite definitely with known species and 6 differed only in minor characteristics from recognized species. Upon the basis of correlated characteristics, 8 types were differentiated from previously described species but new specific designations were not given to these pending further comparative study.

The heat resistance of the organisms isolated was low; only a few strains in 3 types resisted 61.7° C. for 5 or 10 minutes and all were destroyed by 30 minutes at this temperature.

The defects produced by representative cultures of the various types when inoculated into cream or unsalted butter ranged from very pronounced off-flavors to no off-flavors. Bitterness and proteolytic and lipolytic defects were of the greatest significance, although a number of other types were encountered at the less-serious level. The presence of *S. lactis* enhanced the development of off-flavors in many cases.

The widespread distribution of non-lactose-fermenting yeasts and yeast-like fungi in cream and butter and their ability in many cases to cause defects indicate they may be of significance under some circumstances in the deterioration of these dairy products.

M26. Improvements in the Phosphatase Test Applied to Milk and to Cheese. GEORGE P. SANDERS AND OSCAR S. SAGER, Division of Dairy Research Laboratories, Bureau of Dairy Industry, Agricultural Research Administration, U. S. Department of Agriculture.

A modification of the phosphatase test for detecting under-pasteurization of milk has been developed for application to Cheddar cheese, and this modification has been applied also in testing fluid milk.

Research on the conditions and substances that cause interference in the test has been conducted, and the modifications found effective in minimizing the interferences are described. The resulting test has been found to yield results that are more precise for detecting under-pasteurization, both in milk

and in Cheddar cheese, than those obtained with the tests available heretofore.

In tests on whole milk and on non-ripened cheese, contamination of the pasteurized milk with as little as 0.05 per cent of raw milk (1 pound in 2,000) can be detected. The test applied to cheese has been found reliable for detecting under-pasteurization adequately, regardless of the age of the cheese.

M27. The Relationship of the Growth Rates of all Bacteria and Coliform Bacteria in Pasteurized Milk Held at Refrigeration Temperatures. A. C. DAHLBERG, Department of Dairy Industry, Cornell University, Ithaca, N. Y.

In a study of the milk supply of New York City, it was found that the coliform bacteria in pasteurized market milk held at refrigeration temperatures increased more rapidly in numbers than the total count. In the freshly pasteurized milk less than 0.02 per cent of the total bacteria were coliform types. At 35–40° F. the percentage of the total bacteria which were coliform did not increase in October, but in July and August increased to 1.12 per cent in 4 days. After storage for 4 days at 45–50° F. and at 55–60° F. the coliform bacteria constituted about 5 per cent of the total count in October and 88 and 50 per cent of the total count in July and August. The coliform bacteria grew relatively more rapidly in warm weather than in cool weather.

CHEMISTRY, SANITATION, TEACHING

M28. Some Observations Regarding the Effect of Various Wave Lengths of Light on the Riboflavin Content and Flavor of Milk. D. V. JOSEPHSON, Department of Dairy Technology, Ohio State University.

A series of specially constructed glass exposure cells were made to facilitate a study of the effect of various wave-length ranges of light on the riboflavin content and flavor of milk. The cells were constructed so as to permit the mounting of various light filters on the exposure surface. Each cell was divided into three separate compartments by glass plates. The compartments varied in depth from 0.12 to 0.4 inch and were in no way connected with adjacent sections. The cells, including the cell dividers, were made of "water-white" plate glass cemented together with Vinylseal. All surfaces except that exposed to light were covered with black oilcloth so that light rays entering the first compartment from the exposure surface had to penetrate three plates of glass and from 0.32 to 0.52 inches of milk (depending on cell construction) to reach the milk in the back compartment. In most of the studies, the cells were arranged so that the 0.12-inch compartment

was directly exposed to the light. Riboflavin content and flavor development were measured or observed at different periods of exposure in all compartments.

When a control cell (without light filters) was exposed to direct sunlight (200–400 Weston degrees), the riboflavin loss in the exposed compartment (0.12-inch layer of milk) was extremely rapid. A 70 per cent destruction of this vitamin was not uncommon in the exposed compartment after 20 minutes exposure. After this time, the rate of destruction decreased but after one hour losses ranged from 93.0 to 99.0 per cent. The second compartment (0.2-inch layer of milk) immediately behind the exposed section suffered riboflavin losses varying from about 5.0–10.0 per cent after 20 minutes to 33.0–45.0 per cent after one hour exposure. In the back compartment (0.4-inch layer of milk), no loss of riboflavin resulted in any of the trials. However, when the cell was reversed and the 0.4-inch compartment was made the exposure surface, the loss was 40.0–50.0 per cent in 20 minutes and 80.0–90.0 per cent in one hour. With this compartment used as the exposure surface, no loss of riboflavin was experienced in the middle (0.2-inch) or back (0.12-inch) compartments. From this, it would appear that the rays responsible for riboflavin destruction are incapable of penetrating more than about 0.3 inch of milk.

Trials in which various light filters were adapted to the exposure surfaces of the cells containing homogenized milk demonstrated that the wave lengths of light responsible for the photolysis were those below 520 mμ length (5200 Å). Filters, which cut out all wave lengths below 430, 450, 475, 490 and 500 mμ failed to prevent riboflavin loss, but those which cut out wave lengths of light below 490–500 mμ, afforded fair protection. For example, in one experiment where the milk in the control cell showed a 98.9 per cent loss in the exposed compartment after one hour of exposure, that in similar cells fitted with filters which cut off at 490 and 500 mμ suffered riboflavin losses of 7.1 and 5.4 per cent, respectively. Numerous other filters, which cut out at higher ranges (520–740 mμ), gave complete protection to riboflavin.

The development of "sunlight" flavor in milk exposed in these cells presented an interesting but different picture. To prevent the development of "sunlight" flavor in the milk in the exposed cell, a filter which eliminated all wave lengths below 620 mμ was required. With certain milks and with very strong sunlight, a slight flavor developed even with this filter. A filter, which eliminated all wave lengths below 740 mμ, gave complete flavor protection. Milks exposed in cells fitted with filters, which cut off at 530, 550, 570, and 590 mμ, developed the same degree of "sunlight" flavor as the milks in control cells without filters. This would suggest the possibility that the rays responsible for "sunlight" flavor development are those in the 590–630 mμ band. Because of the inavailability of a complete range of filters cutting

off above 620 mμ, the maximum point for complete protection under all conditions could not be determined.

The longer wave lengths of light, which are responsible for the sunlight flavor, have greater penetrating powers than those responsible for riboflavin photolysis. In all trials (without light filters), the "sunlight" flavor developed in all compartments of the cells. By the use of the varying-depth cells, it was demonstrated that these wave lengths could penetrate three plates of glass (compartment dividers) and 0.6 inches of milk and produce the flavor in the back compartment.

The development of "sunlight" flavor is undoubtedly a very complex oxidation-reduction process. In some studies with special cells, the flavor developed very rapidly in the exposed compartment, but on further exposure disappeared almost entirely. In some experiments the milk in the exposed compartment exhibited a strong sunlight flavor after 15 minutes of exposure, while that in the middle and back compartments showed somewhat less. However, after one hour, the degree of flavor development was the reverse, with the back cell exhibiting the strongest flavor.

Freshly pasteurized milk developed the "sunlight" flavor more quickly and to a greater degree than did the same milk after aging. After 3–6 days of storage in a refrigerator, it was frequently difficult to produce any degree of "sunlight" flavor in milk even with long-time exposure. In a few cases, an "oxidized" flavor developed in these exposed aged milks.

Although the evidence is inconclusive at this time, it would appear that the "sunlight" flavor in fresh pasteurized milk (without metallic contamination) may be the result of the production of a complex reducing substance which in turn may actually have an anti-oxygenic effect on the oxidizable lipids.

M29. Sanitization of Creamery Water Supplies with Various Bactericides. C. JENSEN, Department of Dairy Husbandry, North Dakota Agricultural College, Fargo, North Dakota.

Bacteriological investigation of 148 samples of creamery water revealed that 80 per cent of them contained sufficient numbers of fat- and protein-decomposing bacteria to be of importance in regard to butter deterioration.

Studies were made of various bactericidal agents including sodium hypochlorite and various surface-active compounds from the standpoint of sanitizing creamery water supplies. The surface-active compounds investigated were cetyl pyridinium chloride (Ceepryn), alkyl-dimethyl benzyl ammonium chloride (Emulsept and Roccal), di-isobutyl phenoxy ethoxy ethyl dimethyl benzyl ammonium chloride (Hyamine 1622) and di-isobutyl cresoxy ethoxy ethyl dimethyl benzyl ammonium chloride (Hyamine 10–X). Results indicate that sodium hypochlorite and the surface-active compounds studied are highly effective germicides in the treatment of water which has

previously been filtered to remove organic residue and with the pH adjusted so as to obtain the most efficient action from the bactericide. The bactericidal action of sodium hypochlorite decreased rapidly with increased concentration of hydroxyl ions in water. It was also affected materially by the presence of organic matter in the water.

With the exception of Ceepryn, the bactericidal activities of the surface-active compounds were affected to a marked degree by variation in the pH level of the solutions.

Lethal doses of the various bactericides were employed for washing butter granules without producing appreciable signs of flavor defects in butter.

M30. The Manufacture of Powdered Cream-Mix for Whipping by Aeration. HARRY PYENSON AND P. H. TRACY, Department of Dairy Husbandry, University of Illinois, Urbana, Illinois.

A new dried cream-mix has been developed for whipping by Aeration consisting of approximately 30 per cent butterfat, 7.5–8 per cent M.S.N.F., 5 per cent sugar and 0.2–0.3 per cent whipping agent on a reconstituted basis. This product when whipped by aeration produces a whipped cream product quite similar to that whipped from a fresh sweet cream-mix. Where it is often difficult to obtain fresh cream of the proper quality or where the supply is not adequate, this cream-mix can readily be stored in powder form and used when needed.

The cream-mix may either be dried with or without sugar. The sugar can be mechanically mixed with the powdered cream or added to the water at the time of reconstitution. Large or small nozzle size does not seem to affect appearance or whipping ability of the reconstituted powdered cream-mix. Homogenization pressure is detrimental to the whipping properties of the reconstituted cream-mix.

The keeping quality of the dried cream-mix can be improved by packing in inert gas and by the addition of certain antioxidants before drying. The most effective antioxidants of those studied are nordihydroguiaretic acid, gallic acid, and sodium Arabo ascorbate.

Powdered cream-mix produced in these experiments had an average composition of 68.8 per cent butterfat, 99.29 per cent total solids, 0.7 per cent moisture, 2.8 p.p.m. iron and 1.02 p.p.m. copper.

M31. Influence of Nonfat Dry Milk Solids on the Nutritive Value of Bread. LLOYD K. RIGGS, ANNABEL BEATY, AND ARNOLD H. JOHNSON, Kraft Foods Company, Chicago, Illinois, and National Dairy Research Laboratories, Baltimore, Maryland.

The nutritive values of several breads were determined by feeding bread crumbs supplemented with cod-liver oil to growing rats for eight weeks and

noting the number of grams of bread solids required to produce one gram gain in weight. The following types of bread were studied both with and without the addition of 6 per cent nonfat dry milk solids: (1) two lots of whole wheat bread, (2) white bread enriched according to the 1943 standards, and (3) white bread.

The addition of 6 per cent nonfat dry milk solids improved the nutritive value of all these breads. One lot of whole wheat bread had a higher than average protein content and an unusually high nutritive value. White bread containing 6 per cent nonfat dry milk solids was superior in nutritive value to enriched white bread both from the standpoint of growth promotion and chemical composition of the carcasses. Enriched white bread containing 6 per cent nonfat dry milk solids was equivalent in nutritive value to whole wheat bread of average composition as measured by growth promotion and carcass composition. On the basis of grams of bread solids required for a one-gram gain there was no difference between the nutritive values of enriched white bread containing 6 per cent nonfat dry milk solids and white bread containing 6 per cent nonfat dry milk solids.

M32. A Device to Aid in Determining the Effectiveness of Dairy Detergents. E. L. Fouts and T. R. Freeman, Florida Agricultural Experiment Station, Gainesville, Florida.

An experimental project is being conducted to determine the effectiveness of various brands of dairy detergents in washing dairy equipment and utentils on dairy farms and in dairy manufacturing plants. Water composition varies greatly throughout the state and a large number of washing powders are being offered for sale to the dairymen. It is not the purpose of this paper to report the results of the experiments on washing powders but to give information about a machine which was devised to aid in the washing trials. The machine has been named the Deterg-O-Meter.

The machine consists of a 16-inch metal bicycle wheel mounted in a pivoted frame which permits vertical movement, powered by an electric motor and geared to turn 7 revolutions per minute. A baked-on milk film is prepared on glass microscope slides under carefully controlled conditions. Eighteen of these slides with the milk film on them are then mounted on the rim of the wheel and held secure by metal clips. Water at a specified temperature, containing the required amount of washing powder is placed in a specially constructed pan. The wheel is lowered into the pan so that the slides dip into the water as the wheel turns and then are passed over a sponge rubber brush just as the slides emerge from the water. The slides are carefully observed and when clean they are removed from the wheel. The average number of revolutions required to clean the slides is taken as an index of the effectiveness of the washing powder. Other factors also are to be considered in evaluating the detergents.

M33. Some Experimental Results with a Centrifugal Separator the Bowl of Which Is Sanitized by Flushing Action. E. O. HERREID, R. V. HUSSONG, AND P. H. TRACY, Illinois Agricultural Experiment Station.

In 1938, H. W. Fawcett, of W. and J. Whitehead, Ltd., in Laisterdyke, England, brought a centrifugal separator to the Illinois Agricultural Experiment Station. This machine was similar to modern separators in construction except for certain features of bowl design. This bowl is designed to be cleaned by flushing action. It has a distributor which conducts washing solutions from the supply tank to all internal parts. In the shell of the bowl there are three outlet parts, equal distances apart. Each part is closed by a valve which is held in place by a steel spring. The centrifugal force closes the parts tightly when the bowl is revolving at normal speed. When the speed diminishes to about two-thirds that of normal, the valves open, and sanitizing solutions can be made to flow through the bowl with a turbulent cleansing action.

Some experiments were conducted with this separator in 1938. The results indicated that the principle of sanitizing the bowl without disassembling it daily was adaptable to farm use. The outbreak of World War II delayed further experimental work.

In July, 1945, an improved model of this separator was sent by H. W. Fawcett to the Illinois Agricultural Experiment Station. Ninety-eight experimental separations were made. The bowl of this English machine was cleaned by centrifugal flushing action, after each separation in the morning and in the evening, over periods of one week. Before each separation, water at 170° F., from the supply tank, was run through the tinware and the bowl. In the great majority of cases, there was no significant contamination from one separation to the next as revealed by plate counts of the cream and skim milk. The skim milk from the English machine averaged 0.08 per cent by the American Association test.

M34. An "In-Training" Course for Workers in The Dairy Manufactures Industry. P. H. TRACY AND E. O. HERREID, Department Dairy Husbandry, University of Illinois, Urbana, Illinois.

There is much evidence of increased interest in adult education on the part of both our rural and urban population. Dairy departments have an ever-increasing educational responsibility to the dairy industry. This obligation can be fulfilled in various ways, such as, short courses, conferences and in-training courses given by extension. The latter approach to the problem has been recently studied by the Dairy Department of the University of Illinois. Courses in Principles of Dairy Technology, Dairy Bacteriology, and Dairy Production have been given. Other courses in salesmanship, and supervisory training have been given by the University

Extension Division. In all, approximately 1,000 students have been trained during the past year in Chicago. Of these, 660 were registered in the beginning course in the Principles of Dairy Technology.

The qualification of those registered in the beginning course varied as indicated by the following summary.

I. *Educational Background*

100%	Attended grammar school
96%	Graduated from grammar school
80%	Attended high school
45%	Graduated from high school
21%	Attended college
5%	Graduated from college

II. *Age Distribution*

Age (years)	%
17–20	1.75
21–25	5.0
26–30	11.0
31–35	20.0
36–40	21.0
41–45	19.0
46–50	15.0
51–55	5.25
56–61	2.0

III. *Length of Experience (Dairy Industry)*

Period of time employed	%
No previous experience	55.5
1–12 months	4.5
1–2 years	5.0
3–5 years	8.5
6–10 years	6.25
11–15 years	4.5
16–20 years	7.75
21–25 years	4.0
26–31 years	1.75
Not indicated	2.25

IV. *Nature of work done*

Work done	%
Field work	2.0
Engineering	3.0
Supervisory	15.0
Plant Operation	20.5
Sales & Delivery	47.5
Office	9.5
Official & Owners	2.5

The students are registered by a representative of the Registrar's office. A fee of $10 per semester is charged. Classes are held once a week for 16 weeks at the John Marshall Law school. Length of class period—100 minutes. Periodic written quizzes and a final examination are given. Roll is taken at each meeting. A printed copy of all lectures is given each student. In one class of about 350 students, 68 per cent finished the course. The percentage attendance of those who finished was 94. The average grade in the course was 81.6. A certificate is given all who satisfactorily complete the course.

PRODUCTION SECTION

VITAMINS

P1. The Effect of Massive Doses of Vitamin D on the Blood Picture of of Dairy Cows at Parturition. J. W. Hibbs, Ohio Agricultural Experiment Station, Wooster, Ohio.

A study has been made of the effects of feeding large amounts of vitamin

D in the form of irradiated yeast and irradiated ergosterol in oil on the changes in serum calcium, phosphorus, and magnesium before and after freshening.

The feeding of 1 million units of vitamin D daily as irradiated yeast for 30 days before and 7 days after freshening did not cause any changes in the serum calcium, phosphorus, or magnesium of cows fresh normally or with milk fever as compared with control animals.

When 2 million units were fed according to the same plan an increase in serum calcium and phosphorus occurred before parturition.

When 5 million units of vitamin D in the form or irradiated ergosterol in oil (1 million units per gram) were fed daily for 14 days before the expected due date and for 3 days after parturition a still further increase in serum calcium was produced before freshening (12 mg. per cent as compared with 9.8 mg. per cent for the controls). However, regardless of the level to which serum calcium was raised before parturition the level within 12 hours after parturition was found to be between 9 and 9.5 mg. per cent in cows that did not develop milk fever.

In control cows that developed milk fever there was a tendency for the serum calcium and phosphorus to be markedly lower 12 hours before parturition than in control cows that freshened normally. When vitamin D was fed and milk fever developed there was a tendency 12 hours before parturition for the serum calcium to be relatively high, proportional to the amount fed. This increase was offset by a rapid decline after parturition until milk fever symptoms appeared.

Serum magnesium in nearly every case increased concurrent with the decrease in serum calcium in both normal and milk fever cows. There was no marked effect on serum magnesium as a result of feeding vitamin D.

The results of this study show that the feeding of vitamin D to cows before parturition will cause an increase in serum calcium and phosphorus before parturition. However, this increase is nullified within 12 hours after parturition since blood calcium is equal at this time in both vitamin D fed and control animals. Therefore a decrease in milk fever incidence is not to be expected from feeding as much as 5 million units of vitamin D in the form used and under the conditions employed, if the assumption is correct that, to prevent milk fever, blood calcium must be maintained near the normal level during the critical period. Incidence studies bear out this interpretation.

P2. Vitamin A in the Blood and the Liver of Calves, Neonatal and Colostrum-Fed. G. H. WISE, M. J. CALDWELL, F. W. ATKESON, AND J. S. HUGHES, Kansas Agricultural Experiment Station.

Past investigations of the prenatal nutrition of the dairy calf have been limited primarily to studies of the effects of deficiencies in the gestation diet

of the dam. Recent observations indicate possible advantages of adding vitamin A in excess of the minimum necessary for the delivery of a "normal" offspring. Feeding massive amounts of vitamin A, approximately a million U.S.P. units daily during the latter stages of gestation, 8 to 45 days prepartal, effected a significant increase in the vitamin A reserves of the neonatal calf. The averages and ranges in values, γ/100 cc. serum and γ/gram of liver, respectively, were as follows for various prepartal rations fed: Standard winter, 2.3 (0–5.7) and 0.4 (0.2–0.7); standard winter plus pasture, 2.3 (0–4.7) and 0.5 (0.3–0.9), and standard winter plus vitamin A, 8.5 (5.7–11.3) and 5.0 (1.5–8.0).

The vitamin A levels of the blood serum dropped precipitously in the fasting newborn during the first 12 hours. The rate and degree of reduction varied with different individuals, the extremes in extent ranging from 29 per cent to 85 per cent for a 12-hour period. The relation of fasting to liver values have not been determined. Other factors affecting the early post-natal levels of vitamin in the newborn calf have not been explored.

The changes of the vitamin A values in the serum and the liver varied with the potency and amounts of colostrum consumed. The carotene and vitamin A concentration in the colostrum varied widely but reflected, in varying degrees, the vitamin A activity of the prepartal ration.

P3. The Placental Transmission and Fetal Storage of Vitamin A and Carotene in the Bovine. A. A. Spielman, J. W. Thomas, and J. K. Loosli, Department of Animal Husbandry, Cornell University, Ithaca, New York.

Four different rations were fed to 29 Holstein and 4 Guernsey heifers during the last 60 days of their gestation periods. The rations were: wheat straw plus a concentrate mixture, a normal fitting ration of concentrates, hay and corn silage, a normal ration plus one million I.U. of carotene daily, and the normal ration plus one million I.U. of vitamin A daily.

No significant differences were observed in the mean plasma carotene of the newborn calves from the four dietary groups. However, the plasma vitamin A of the newborn calves from the carotene supplemented cows was twice that of the normal group, while the vitamin A supplemented group showed a fourfold increase.

Carotenoids were present in significant amounts in the livers of all newborn calves and varied directly with the carotene content of the maternal prepartum diet.

The addition of one million I.U. of vitamin A daily to the normal ration of pregnant cows resulted in an average total fetal liver storage of 97,177 I.U. of vitamin A.

Evidence has been obtained that the prepartum diet of the normal bovine may influence markedly the vitamin A and carotene reserves of the newborn calf.

P4. Utilizing all Colostrum in Calf Feeding. H. E. KAESER AND T. S. SUTTON, The Ohio State University and The Ohio Agricultural Experiment Station.

The importance of colostrum in the nutrition of the calf is well established, yet a large amount of this important calf feed is either wasted or used in such a way that greatest benefits are not obtained from its superior nutritive value. The belief that prolonged or irregular colostrum feeding will result in "scours" also prevails among practical dairymen. Results in an experiment in which the colostrum feeding period was extended to seven days have been reported. This procedure may not find widespread practical use because of the necessity of storing the excess colostrum for later feeding.

It was considered advisable to study some method of using all of the colostrum produced in the feeding of calves without the inconvenience and hazards of colostrum storage. The present paper is a progress report of this investigation.

At birth the calves are assigned to comparable groups and managed similarly. After three days during which each calf receives colostrum from its own dam Group II receives Holstein milk. Any colostrum remaining after feeding the cow's own calf is used to replace an equal weight of Holstein Milk in feeding Group I. The daily allotment of milk or milk and colostrum is determined by the weight of the calf. Hay and grain are provided ad libitum after the third day. Data are obtained on weight and blood plasma vitamin A and carotene.

The summarized data for 33 calves shows that the calves receiving the extra colostrum maintain higher levels of plasma vitamin A and carotene during the first eight weeks. More rapid gains are also observed during the first four weeks. The average gain of the Group I calves being 19.4 lbs. in comparison with 16.2 for the Group II or control calves.

During the first six weeks the extra colostrum fed calves exhibit a vastly superior physical appearance. There is more gloss to their coat, they appear to carry more flesh and are more alert. The amount of colostrum fed is quite variable, ranging from all the daily allowance to none. Abrupt changes from a diet of Holstein milk to part or all colostrum has not created any problems.

P5. The Effect of Vitamin Supplements on Survival of New-Born Calves.* R. G. HANSEN, P. H. PHILLIPS, AND I. W. RUPEL, University of Wisconsin.

The supplementary effects of vitamin A, niacin and biotin fed singly or in combination has been studied with new-born colostrum-free Holstein

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calves. A basal ration composed of commercial skim milk with an added 250 mg. of ascorbic acid was used in all cases. Two levels of vitamin A were used in these experiments, namely 10,000 and 25,000 I.U.

Calves fed the basal ration normally exhibited a looseness of the bowels regardless of the dietary supplements employed. If the looseness reached a severe stage 2–4 grams of sulfathiazole were given for one day and lighter doses thereafter as the condition of the calf indicated. It was apparent that the level of vitamin A fed affected the degree and frequency of the occurrence of these diarrheas. Severe diarrhea occurred in 8 of 9 calves (89%) given 10,000 I.U. while 25 cases occurred out of a possible 36 (69%) when 25,000 I.U. were fed. The occurrence of severe diarrhea was correlated with season. The incidence of severe diarrheas was higher by three fold during the January–May period than it was in the June–December period. Data on 36 calves fed 25,000 I.U. of vitamin A daily indicate a higher survival rate by 25–30% for the summer–fall period. Eight calves of 23 born during the winter period failed to survive on the basal ration while only 1 out of 13 dropped during the summer–fall period failed to survive on the vitamin A niacin fortified basal ration. The contrast was even more marked in a limited number of observations with Guernsey calves. This evidence indicates that factors other than vitamin A and niacin are involved in the survival of the new-born calf. A nutritional factor, or factors present in the skim milk or improved intra-uterine nutrition is postulated.

Plasma vitamin A concentrations determined at birth, 24–36 hours and 6–14 days indicated values of 4 μg., 10 μg. and 13 μg. of vitamin A per 100 ml. respectively for the colostrum-fed calf. All values at birth were found to be about 4 μg. per 100 ml. which confirms previous observations. Four calves given the basal ration plus 10,000 I.U. of vitamin A only showed little increase in plasma A concentration and only 1 survived. Six calves fed a supplement of 10,000 I.U. plus niacin (50 mg.) had 6 μg. and 12 μg. of vitamin A per 100 ml. at the 24–36 hours, and 6–14-day interval respectively and 50 per cent survived. When the vitamin A level was increased to 25,000 I.U., 27 out of 36 calves survived. At this level of vitamin A administration no measurable supplementary effect of niacin, or niacin and biotin, was observed.

From these studies it appears that (1) new-born calves fed the skim milk basal ration require vitamin A in amounts in excess of 10,000 I.U. per calf per day for better than 50 per cent survival; (2) that 25,000 I.U. per day gives a satisfactory survival rate, (3) that a favorable supplementary niacin effect is not observable when adequate levels of vitamin A are ingested, and (4) that some factor, or factors are present either in "summer skim milk" or in intra-uterine life or both which favorably influences survival of young calves dropped between June 1 and January 1.

P6. The Effect of **Feeding Vitamin A on the Blood Picture and on Liver Storage in Calves.** J. W. HIBBS AND W. E. KRAUSS, Ohio Agricultural Experiment Station, Wooster, Ohio.

In connection with experiments designed to study the effect of supplementary vitamin feeding on the control of scours, a study was made of the blood plasma vitamin A, carotene, and ascorbic acid, and of total vitamin A liver storage of calves under two different systems of supplementary vitamin feeding.

In the first experiment, in which both Holstein and Jersey calves were used, one-half (15) of the calves received a multivitamin capsule every day for the first 20 days. These capsules contained 300 U.S.P. units of vitamin D, 250 mg. of ascorbic acid, 50 mg. of niacin, and 10,000 U.S.P. units of vitamin A. The other half (15) of the calves received a placebo capsule containing a biologically inactive oil.

Blood plasma vitamin A analyses showed that a peak was reached at about 21 micrograms per 100 ml. on the third day. This was followed by a steady decline until the twenty-first day when the control group averaged 11.1 micrograms per 100 ml. and the experimental group 14.8 micrograms per 100 ml. The higher value in the experimental group is attributed to the supplementary vitamin A fed.

Vitamin A storage, aside from carotene, in the liver of some of the male calves showed that the control group had stored approximately 36,000 U.S.P. units while the experimental group had stored approximately 62,000 U.S.P. units.

No difference between the groups was noted in the levels of plasma carotene and ascorbic acid.

In a second experiment three groups were treated as follows: Group I (10 calves) received no vitamin supplement. Group II (13 calves) received 250,000 units of vitamin A in capsule form on the third and tenth days. Group III (12 calves) received 250,000 units of vitamin A on the third and tenth days, plus 50 mg. of niacin daily for the first 20 days.

Vitamin A, carotene, and ascorbic acid determinations were made on the 3rd, 10th, and 20th days. In addition liver vitamin A storage was determined on the 20th day in the male calves. Blood plasma vitamin A and liver storage analyses indicated no significant difference between Groups II and III. At 10 days Groups II and III averaged 17.2 micrograms per 100 ml. whereas Group I averaged 11.2. At 20 days Groups II and III averaged 15.1 and Group I averaged 10.8. At 20 days total vitamin A liver storage determinations showed that Groups II and III had stored an average of 158,000 U.S.P. units more than Group I.

In these experiments scours occurred just as frequently in the groups receiving supplementary vitamins as in the control groups. Plasma vitamin A and carotene, however, were found to be lower in calves that had

scours than in calves that did not have scours. Holstein calves in both experiments showed a higher average level of blood vitamin A and a lower carotene level. Scours were much more prevalent in the Jersey calves.

The falling off of blood vitamin A during the first few weeks can largely be offset by feeding additional vitamin A. It is shown further that regardless of the amount of vitamin A fed the blood level seldom exceeds 25 micrograms and that the blood level is not a good criterion of liver storage except when liver storage is low.

P7. The Relationship of Prepartum Diet to the Carotene and Vitamin A Content of Colostrum. J. W. THOMAS, A. A. SPIELMAN, AND K. L. TURK, Department of Animal Husbandry, Cornell University.

Four different rations were fed to Holstein and Guernsey cows during the last sixty days of their gestation period.

The rations used and the number of animals in each were: (A) Straw plus a concentrate mixture, nine animals; (B) Fitting ration consisting of mixed hay, corn silage, and concentrate mixture, six animals; (C) Fitting ration plus one million I.U. of carotene in oil, six animals; (D) Fitting ration plus one million I.U. of vitamin A as a fish-liver oil concentrate, seven animals.

All animals were fed the herd ration as soon as they freshened. Samples of the first and sixth milkings were obtained for carotene and vitamin A analysis. With some cows the total colostrum produced during the first three days was collected. This was analyzed and the total output of carotene and vitamin A in the colostrum was obtained.

The vitamin A concentration in the first milking of cows on rations (A), (B), and (C) was approximately the same, averaging 3.5 micrograms per ml., about eighteen times that in normal milk. Group (D) produced colostrum with 6.3 micrograms of vitamin A per ml. The carotene concentration in the first colostrum sample of group (C) was somewhat higher than in the other groups.

In the sixth milking the concentration of vitamin A of group (D) was three times that of the other groups. The carotene concentration of the sixth milking was highest in group (C) while group (A) was noticeably lower than either group (B) or (D).

The results expressed per gram of fat show the same relationship in both the first and the sixth milkings.

The first colostrum sample of one of the vitamin A supplemented cows analyzed 61.5 micrograms of carotene and 886 micrograms of vitamin A per gram of butterfat.

The total vitamin A output in the first three days' colostrum was variable within each group. The averages were 170 mg. for four vitamin A supple-

mented cows, 53 mg. for nine cows fed the normal fitting ration, and approximately the same for four cows supplemented with carotene. Total carotene output of the carotene supplemented group was double that of groups (B) and (D).

The concentration and total output of vitamin A and carotene in cow's colostrum has been demonstrated to be influenced by the ration fed during the two months immediately prior to parturition.

P8. Vitamin A and Globulin Content of Colostrum Milk.* R. G. HANSEN, P. H. PHILLIPS, J. W. WILLIAMS, AND V. R. SMITH, University of Wisconsin.

The vitamin A content of colostrum milk from 43 cows has been studied with particular reference to the rate of decline, the effect of number of lactations and the effect of milking procedure upon vitamin A concentration of colostrum. Further, the effect of colostrum upon the serum protein fractions of calf blood have been studied.

Colostrum milk samples were obtained from cows which had been completely milked out the first two milkings either with or without the aid of oxytocin. The samples were quickly frozen and stored at $-4°$ C. until analyses could be made.

The results show that in eighteen Holstein heifers fed identical rations that the vitamin A content of the colostrum from the first lactation was more than double the vitamin A content of the colostrum from the second lactation, while the carotene content of the colostrum was about the same for each of the two lactations. With cows that were allowed to remain with the calves but in addition were milked out "to balance the udder" the chief drop in vitamin A potency occurred during the first three milkings. Thereafter there was a gradual decline to normal concentrations in milk. With cows isolated from the calves the vitamin A potency of their colostrum from the first and second milkings was about the same. However, with cows which were allowed to remain with the calves and were milked out twice daily, there was a decided drop in vitamin A potency between the first and second milking. The intravenous injection of 10 I.U. of oxytocin at the time of milking in cows isolated from their calves caused a decided drop in vitamin A potency from the first to the second milking.

The serum protein fractions of colostrum-fed calves and colostrum-free calves fed skim milk were studied electrophoretically. At birth the gamma globulin component of all calves was extremely low. Within eighteen hours after the ingestion of colostrum the gamma globulin fraction increased to approximately 10 per cent of the serum proteins. In this same period the beta globulin showed a slight increase while the alpha globulin fraction showed a corresponding decrease. The albumin fraction appeared to be

* This project was supported in part by Merck and Co., Inc., Rahway, New Jersey.

unchanged. In calves fed skim milk the gamma globulin fraction had increased only slightly at two weeks time and even at eight weeks had not reached a normal level. In one new-born colostrum-free calf the serum gamma globulin fraction increased significantly when the calf was fed skim milk plus seventy grams of gamma globulin isolated from colostrum. There was no increase in gamma globulin component in a seventeen-day-old calf, which had been fed on skim milk from birth, when seventy grams of gamma globulin isolated from colostrum were given.

P9. The Effect of Vitamin A Deficiency on Reproduction in Dairy Bulls. R. E. Hodgson, S. R. Hall, W. J. Sweetman, H. G. Wiseman, and H. T. Converse, Bureau of Dairy Industry, Agricultural Research Administration, United States Department of Agriculture.

Twelve dairy bulls were made to develop typical vitamin A deficiency symptoms at different ages by adjusting their vitamin A intake. Their breeding abilities and the quality and fertilizing capacities of their semen which they produced while in a deficient condition and in some cases while supplemental carotene was fed after a period of avitaminosis A was studied.

When deficiency symptoms appeared before the expected breeding age, bulls failed to breed; when they appeared at about the breeding age they frequently failed to breed shortly thereafter, but when they appeared after they had started breeding this capacity was maintained. Bulls that would not mount and serve the artificial vagina invariably yielded semen by the massage technique. Seven of the vitamin A-deficient bulls (all that were tested more than twice) were proved fertile by artificially inseminated cows.

Generally the semen produced by vitamin A-deficient bulls was low in concentration, had a high percentage of abnormal sperm, a high pH, and did not store well.

At autopsy the bulls all had cystic pituitary glands; three bulls with badly damaged glands were proved fertile. The epithelium of the seminiferous tubules of the testes of the bulls was found to have undergone degeneration—in some cases extensively.

Four bulls that had lost their ability to breed, when fed 8 to 11 micrograms of supplemental carotene per pound weight daily, started breeding but the quality of the semen was not substantially improved.

P10. Relation of Carotene Levels to Fertility in Dairy Bulls. I. R. Jones, J. O. Schnautz, and J. R. Haag, Oregon State College.

This study has been continued using the same carotene-deficient ration of molasses, dried beet pulp and a grain mixture supplemented with minerals and vitamin D as first reported at the 1944 annual meeting. Of the five bulls on experiment at present, Nos. 51 and 55 have received alfalfa meal to supply daily approximately 25 micrograms of carotene per kilogram of

body weight; and Nos. 52 and 59, 35 micrograms carotene per kilogram of body weight. Bull No. 57 was fed 65 micrograms of carotene per kilogram of body weight until 445 days of age, when the level was reduced to 15 micrograms. Bull No. 60, being fed at the 65 micrograms of carotene level, broke a leg in his stall at 450 days of age and was killed.

The bulls now about 3½ years of age, range in size from about 1250 to 1450 pounds without any particular relation indicated between the carotene level fed and the weight of the animals.

Four of the five bulls have been used in natural service and semen has been collected artificially for examination. One bull, No. 55, has never shown sexual desire and thus has neither service nor examination records. This particular bull has always been quite timid whereas the other bulls, Nos. 51 and 52, that became blind in their early growing period, have shown normal bull behavior.

It has been noted that cows calving became pregnant to a small number of average services. Cows not becoming pregnant were usually bred only once.

Semen samples have usually shown excellent original motility and good duration of motility in stored samples in the case of Nos. 57, 52, and 59. Samples from No. 51 have been quite variable in original motility but the duration of motility has been good. Bull. No. 59 has at times been slow on service and twice has refused service.

It appears from the results to date that carotene levels in the range of 15 to 35 micrograms per kilogram of body weight are sufficient to allow Jersey bulls to retain their fertility.

HORMONES, BLOOD, AND DISEASE

P11. The Adrenal Cortex in Relation to Ketosis in Dairy Cows. J. C. SHAW, University of Maryland.

The subcutaneous administration of from 100 to 150 ml. of adrenal cortex extract (Wilson) per day resulted in marked improvement within 24 hours in both the symptoms and the blood picture in each of the four cases studied. A number of tests were conducted to determine whether an adrenal insufficiency is involved in the development of ketosis in cows. The following favor the view that such an insufficiency is involved: (1) Ketosis in cows is a hypoglycemic condition, (2) the symptoms are often apparent at glucose levels which do not produce symptoms in normal cows, (3) cortical extract has elicited a favorable response in each of four cases studied, (4) cows with ketosis are more sensitive to insulin injections than normal cows, and (5) the blood glucose response to adrenalin injections is slight. The following are not in accord with the view that an adrenal insufficiency is involved in the development of ketosis in dairy cows: (a) the plasma sodium and potassium are normal, (b) the intravenous glucose tolerance curve is not typical

of that observed in cortical insufficiency and (c) cows with mild cases of ketosis usually recover following a single intravenous injection of glucose. While some of the data cannot be properly evaluated until information is obtained on adrenalectomized cattle, it is believed that the data obtained so far favor the view that ketosis in cattle is not due to an adrenal insufficiency. Since extracts of the adrenal cortex promote glyconeogenesis even in normal animals, this material may have a beneficial effect even though an adrenal insufficiency is not involved.

P12. Effects of Stilbestrol on Lactation and Reproduction. SIDNEY P. MARSHALL,* R. B. BECKER, AND P. T. DIX ARNOLD, Florida Agricultural Experiment Station, Gainesville, Fla.

Diethylstilbestrol, or stilbestrol, was synthesized in England in 1938, and in 1940 was found to stimulate udder development and lactation in goats. An entire issue of Journal of Endocrinology (Jan., 1944) reported investigations in England with cows and virgin heifers. The compound was used on heifers, cows, and goats at the Minnesota, Missouri, Kentucky, and Louisiana stations, usually causing rapid development of the udder with subsequent milk secretion. It appeared to depress milk production with animals already in lactation.

Methods

At the Florida station, 14 heifers and 5 dry cows were injected subcutaneously with stilbestrol dispersed in "Wesson" cottonseed oil (10 mgm. per ml.). Each animal received 1 milliliter daily for 5 days, then 3 injections weekly of 2 milliliters until lactation began. With some, the injections were continued for 32 to 89 days longer.

Sexual excitation

Early evidence of reaction to stilbestrol was marked sexual excitation, extending over 2 to 4 days in 16 out of 87 instances observed. Injections were discontinued at initiation of lactation with 10 animals, 4 of which showed excitation later a total of 6 times. Excitation continued longer among the 8 heifers and 1 cow with the injections continued into lactation. More generally, a quiescent period followed discontinuance of injections.

Udder development and milk yields

Responses of udder development to stilbestrol varied widely. Lactation began in the heifers in 14 to 64 days. One cow lost flesh; did not come into milk, and was discontinued ofter 71 days. Between 13 and 53 milligrams of stilbestrol were administered per animal to time of lactation, with a total of 71 to 93 milligrams in the heifers with injections continued into lactation.

The animals were milked by machine twice daily after fullness of the

* Now at Clemson Agricultural College, Clemson, S. Car.

teats indicated that milk secretion had begun. Secretion was at a lower level, and the peak of lactation appeared to be attained more slowly than with 17 related animals following normal calving. The average peak of production over 10-day periods ranged between 13 and 24 pounds of milk daily, tending to be lower among the animals with which injections were discontinued at first milking. Milk yields in 300 days ranged between 2,838 and 4,151 pounds each for the heifers. One cow completed 300 days with a yield of 4,080 pounds of milk. Seven heifers milked from 400 to 644 days. Continuation of lactation long after injections ceased may be explainable as maintained primarily by mechanical stimulation.

Reproduction

The initial sexual excitation was independent of ovulation. Intentionally, no animal was bred during the first 90 days in lactation. Discontinuance of stilbestrol injections was followed by sexual quiescence. Later, 6 animals were bred on apparent estrus a total of 7 times, resulting in a single conception. Since most animals in this investigation were irregular breeders when selected, the low proportion of conception cannot be attributed to the stilbestrol.

P13. Elimination of Male Hormone by Lactating Dairy Cows. C. W. Turner, Missouri Agricultural Experiment Station.

Riley and Hammond (1942) presented the first evidence that dairy cattle excreted appreciable amounts of androgenic hormones in the feces. When baby chicks were fed dried cow manure as an ingredient of the starter ration, the chicks' combs developed an intense red color and grew in size precociously.

This observation was of interest to us from several points of view. If true, dried cow manure would serve as a cheap source of androgenic hormone for feeding experiments. Second, it would be of interest to determine the factors influencing the rate of male hormone elimination in male and female cattle. Third, it would enable one to determine the normal role of the male hormone, if any, in the growth of the udder, and the secretion and maintenance of milk production.

While our observations are still quite limited, I have confirmed the report of the elimination of relatively large amounts of androgenic hormone in the feces of lactating dairy cows. The cow manure assayed showed the presence of androgens in one kilo equal orally to the effect produced by the feeding of 200 mg. of methyl testosterone to chicks during a 4-week period. The manure from bulls contained much less. Manure from non-lactating sheep and goats also contained less male hormone than from lactating cows.

While a few reports on the stimulating effect of androgens upon the growth of the mammary gland and the lactogenic hormone have been made,

the observation of the normal elimination of large amounts of androgens by lactating dairy cows will stimulate renewed interest in the normal role of this hormone in lactation.

P14. A Technique for Intravenous Feeding of Ruminants with Some Observations on the Effect of the Administration of Various Substances upon the Secretion of Milk Fat. A. I. MANN, University of Connecticut and J. C. SHAW, University of Maryland.

Various substances were fed as the sole source of nutriment to lactating goats or cows via the abomasum by means of a rubber catheter and by intravenous administration by the technique described below. A No. 10 rubber catheter was fixed in the subcutaneous abdominal mammary vein. The catheter was attached to a constant drip bottle by means of rubber tubing. By placing a pulley and a sliding weight between the drip bottle and the catheter, the animal was able to lie down at will. Triacetin and glucose fed at a constant rate intra-abomasally for 19 and 41 hours respectively did not prevent the decrease in lower fatty acids and increase in unsaturation of milk fat typical of fasting. Constant intravenous feeding of glucose, protein hydrolysates, sodium acetate and sodium oleate likewise did not prevent these changes. As much as 1985 gm. of glucose was injected during a 47-hour period, 1984 gm. of sodium acetate during a 22-hour period, and 138 gm. of oleic acid during a 15½-hour period. In the latter case, the cow was fasted for approximately 20 hours before the oleic acid was administered. The Polenske and Reichert-Meissl values obtained indicate that none of the above materials serve as a precursor of the lower acids of milk fat. Various fat emulsions were prepared. Purified phosphatides were used in one preparation as a stabilizer. In another, a monoglyceride and bile salts were used. These preparations were homogenized at 3,000 lbs. pressure. Emulsions were prepared in which the average diameter of the fat globule was approximately 1 micron. The intravenous injection of these fat emulsions in quantities as low as 10 ml. produced immediate and severe anoxia.

P15. Blood Studies of Louisiana Dairy Cows. II. Calcium, Inorganic Phosphorus, Hemoglobin Value, Erythrocyte Count, Leucocyte Count, and Percentages of Types of Leucocytes. L. L. RUSOFF AND P. L. PIERCY,* Louisiana Agricultural Experiment Station.

Variations in the blood picture of high-producing dairy animals in two separate herds which were fed and managed better than average is presented. The blood picture of low producing animals of an experimental herd which were on a basal diet containing poor quality hay as the only source of rough-

* Dairy Research and Veterinary Medicine Departments, respectively.

age, supplemented with either Ca or P, or both Ca and P, or no minerals, is included.

Analysis were made on pooled citrated blood drawn on three consecutive days from 38–46 animals every month or every two months over a period of approximately 2 years.

A statistical analysis of 753 determinations for Ca and P, and 613 observations for each of the other constituents was made. Using the analysis of variance it was found that significant differences existed between animals in a herd and between months (within animals) for calcium and phosphorus values. There were significant differences between months (within animals) in a herd for hemoglobin values, and between animals for the leucocyte count. No significant seasonal variations were found. Only low and non-significant correlations were found between either Ca or P and the hemoglobin value, erythrocyte, or leucocyte counts. Significant differences were found between herds for hemoglobin content, erythrocyte count, leucocyte count, percentages of lymphocytes, neutrophiles and monocytes.

Poor quality hay in the ration of the experimental herd did not seem to influence the blood calcium content or amounts of the various cellular constituents, but the phosphorus and hemoglobin values were significantly different from those of the other herds.

The range of means and their standard errors for the herds are as follows:

Calcium, 10.89 $\pm$ 0.21 to 11.36 $\pm$ 0.15 mg. % plasma.
Phosphorus, 5.02 $\pm$ 0.07 to 5.77 $\pm$ 0.13 mg. % plasma.
Hemoglobin, 11.19 $\pm$ 0.27 to 13.39 $\pm$ 0.22 gm. per 100 cc. blood.
Erythrocytes, 4.89 $\pm$ 0.030 to 5.72 $\pm$ 0.035 millions per cmm. blood.
Leucocytes, 8,411 $\pm$ 0.31 to 10,268 $\pm$ 0.45 per cmm. blood.
Lymphocytes, 54.46 $\pm$ 0.86 to 57.26 $\pm$ 0.79%.
Neutrophiles, 29.35 $\pm$ 0.65 to 32.64 $\pm$ 0.87%.
Eosinophiles, 6.40 $\pm$ 0.38 to 7.32 $\pm$ 0.37%.
Monocytes, 5.49 $\pm$ 0.06 to 6.38 $\pm$ 0.04%.
Basophiles, 0.37 $\pm$ 0.09 to 0.58 $\pm$ 0.08%.

P16. Studies of the Growth and Blood Composition of Dairy Calves Fed Remade Skimmed Milk after Three Days of Age. P. M. REAVES AND L. R. ARRINGTON, Virginia Polytechnic Institute.

Calves were removed from their dams on the third day after birth and placed on an experimental ration of remade skimmed milk supplemented with vitamins A and D in the form of carotene and viosterol or cod-liver oil. Grain and hay were fed as soon as the calves would eat it.

Calves of the Holstein breed were raised to practically normal size at four months of age by this method. The results with Jersey calves were only partially successful. There was no difference in the calves receiving the different vitamin supplements.

The fat content of the blood of the calves fed remade skimmed milk was lower than that of a control calf fed whole milk. When the calves on skimmed milk consumed considerable quantities of hay and grain the blood fat rose to a level as high as that of the control calf on whole milk.

The blood carotene was higher in the calves receiving the carotene supplements than that of the control calf on whole milk or that of the experimental calves receiving cod-liver oil as a supplement.

The vitamin A content of the blood was higher in calves fed cod-liver oil as a supplement than in the case of the control calf or of the calves fed the carotene concentrate.

P17. The Effect of Complete Milking on Blood Serum Calcium of Cows at Parturition. VEARL R. SMITH, University of Wisconsin.

This study was undertaken to ascertain the effect of complete milking shortly after calving on the blood serum calcium. The cows were of Holstein, Jersey, and Guernsey breeds. The cows were divided into two groups by alternating at freshening within a breed.

The cows in the control group were managed conventionally by permitting the calves to remain with the cows for three days after calving. The cows in this group were partially milked twice daily beginning the day subsequent to calving.

The calves were removed from the dams of the experimental group before nursing, and the cows were milked completely with the aid of an injection of 10 I.U. of oxytocin, usually within an hour of calving. Oxytocin injections were made at each milking for the first five days subsequent to calving.

Samples of venous blood were drawn daily from five days prior to the anticipated day of parturition, and daily to five days subsequent. The samples were drawn within an hour of the same time daily. Calcium was determined by a modification of the Clark-Collip method.

Calcium determinations have been made on 29 cows: fourteen in the control and fifteen in the experimental group. Five of the cows in the control group have been treated for milk fever, and two in the experimental group. Production data indicate that the cows in the experimental group attained peak production sooner than the cows of the control group.

P18. The Occurrence of Various Bacterial Infections and Their Significance in Bovine Mastitis. L. A. BURKEY, W. W. SWETT, AND CECILIA R. BUCKNER, Bureau of Dairy Industry, Agricultural Research Administration, U. S. Department of Agriculture.

Although the results for mastitis investigations reported elsewhere, and in the past by the Bureau of Dairy Industry, have shown that *Streptococcus agalactiae* is the predominant infective organism associated with bovine

mastitis, detailed studies by this bureau during the last 18 months have shown that bacteria other than *S. agalactiae* are the most frequent cause of mastitis infections.

The results of this study for 1945 show that the percentage of quarters infected with *S. agalactiae* was 6.3, with *S. dysgalactiae* 10.4, with strains of *S. uberis* 25.5, with strains of *S. viridans* 19.1, with strains of *S. fecalis* 10.6, with staphylococci 23.2, and with pseudomonades 4.9. The streptococcal infections during 1945 were 71.9 per cent of the total infections.

The percentages on the same basis for the first 4 months of 1946 were as follows: *S. agalactiae* 0.9, *S. dysgalactiae* 6.1, *S. uberis* 34.0, *S. viridans* 14.0, *S. fecalis* 5.0, staphylococci 28.5, and pseudomonades 11.5. During this period in 1946, the streptococcal infections were 60 per cent of the total infections.

A definite explanation for the recent decrease of *S. agalactiae* infections in bovine mastitis and the predominance of other bacterial infections, such as *S. uberis, S. viridans,* and staphylococci, and the continued trend in this direction has not been determined. These results have been obtained in conjunction with studies in which all infected quarters have been treated with chemo-therapeutic agents. The results of treatment for 1945 show that *S. dysgalactiae* and *S. agalactiae* are the most susceptible to these treatments, while *S. uberis,* pseudomonades, *S. fecalis, S. viridans,* and staphylococci are definitely less susceptible to the treatments, in the order given.

These results suggest that the greater resistance to treatment by chemotherapy may be one factor responsible for the increased predominance of these infections in a particular herd.

The predominance of *S. uberis* and staphylococci and the continued prevalence of pseudomonades in the herds studied are significant, not only because these organisms are relatively resistant to treatment but also because the infections produced are in most cases equally as serious as *S. agalactiae* infections.

These observations suggest that the future approach to the control of mastitis infections may have to be broadened to adequately provide for the health of the dairy herd.

P19. Some Results in Treating Mastitis by Means of Sulfanilamide, Tyrothricin, and Penicillin. H. A. HERMAN AND O. S. CRISLER,* University of Missouri.

Several of the more recently suggested treatments for mastitis in dairy cows have been used over a 3-year period in the University of Missouri dairy herd.

Sixty-three cows in the Station dairy herd showing streptococci infection, and occasionally staphylococci in one or more quarters were treated

* Department of Dairy Husbandry and Department Veterinary Science cooperating.

by one or combinations of the following udder injections: Colloidal silver oxide (Novoxil), sulfanilamide and mineral oil (Sulvetil), sulfanilamide-iodine-mineral oil, tyrothricin, and more recently penicillin. Diagnostic tests consisted of the Hotis test, microscopic examination of milk, leucotyte count, strip cup, and physical examination of the udder. The infected cows were treated at regular intervals and an examination of the milk made at 2-week intervals following treatment and until the animal maintained a clean test for 12 weeks.

Thirty-four cows (94 quarters) were treated with an emulsion of mineral oil, sulfanilamide (30–35%) and iodine, 1 part to 2000 parts oil. Treatment consisted of daily injections for four days of 50 to 60 cc. of the sulfanilamide, iodine and mineral oil per quarter. Seventy-five to 80 per cent of the quarters were free of streptococci 2 to 4 weeks after treatment and the majority have remained clean. Penicillin has been found to be about 80 per cent effective in treating mastitis infections in 13 cows involving 33 quarters. Treatment consisted of injecting the infected quarters with 100,000 to 200,000 units of penicillin in saline solution, in 2 to 8 doses ranging from 25,000 to 50,000 units per dose.

No swelling or inflammation following the use of penicillin has been noted.

Four cows (11 quarters) were treated with Sulvetil and all but one animal (2 quarters) have become negative.

Twelve cows have been treated with tyrothricin and following one to five treatments all but two have become negative.

Two cows were treated with Novoxil during the dry period. One freshened free of streptococci in the udder and the other was positive.

Sulfanilamide injections produced no swelling or inflammation in the udder. Novoxil treatments resulted in severe swelling and inflammation the first 2 to 5 days following its use.

Tyrothricin produced from mild to fairly pronounced inflammation which persisted from 12 to 40 hours.

P20. The Effect of Ingestion of DDT upon Dairy Cows. N. N. Allen, H. A. Lardy, and H. F. Wilson, University of Wisconsin.

Growers of canning peas have found DDT effective for controlling aphids. The green vines, stored as stack silage, are fed to dairy cows and to meat animals during the winter months, and the question arises as to the possible toxic effect of DDT residue in this silage upon the health of the animals and upon the consumers of their milk and meat.

Pea vines were stored at harvest time in two silos. DDT was added at the rate of 1 pound per ton to the vines in one silo, while the other lot, serving as a control, was ensiled without DDT.

Beginning November 9, the silage was fed to dairy cows at the rate of

3 pounds per 100 pounds live weight daily, with clover hay of fair quality and a 16 per cent protein concentrate. One group of 4 Holsteins and 1 Guernsey received the treated silage, while a similar group was fed the untreated silage. Blood and milk samples were taken frequently during the course of the experiment. Milk from the two lots of cows was fed to rats to test for toxicity.

Three cows received the treated silage for 118 days, one for 141 days, and the fifth was slaughtered after 127 days on the treated silage. One of these dropped a heifer calf after 67 days of silage feeding. This calf received milk from this group of cows for 75 days. A second cow gave birth to a bull calf after 102 days of silage feeding. This calf was slaughtered after 33 days on the milk from the cows receiving treated silage. A third calf, born to a control cow, was given milk from the cows getting the treated silage after the colostrum period to 33 days of age.

None of the animals showed any evidence of toxic effects from the DDT of the silage. The two animals slaughtered showed no gross symptoms in the body organs. The calcium, carotene, vitamin A, ascorbic acid and hemoglobin levels of the blood were not affected. Rats fed milk from the cows receiving the treated silage as the sole diet grew as well as those receiving milk from the control cows, and showed no symptoms of DDT poisoning.

The milk from the cows receiving the treated silage contained 15.6 parts per million of DDT near the close of the experimental feeding period. Analyses of the tissue of the slaughtered animals indicated 3.8 parts per million in the muscle tissue, 6.1 parts per million in the liver, and 221 parts per million in the depot fat of the cow, while the calf had 3.1, 6.2 and 305 parts per million respectively for the corresponding tissues.

One Jersey cow was fed 24 gm. of DDT daily mixed with her feed for a period of 157 days without showing any symptoms of toxicosis. Her milk contained 44 parts per million of DDT and was sufficiently toxic to inhibit growth of rats. Her depot fat, sampled by biotomy one month after discontinuing DDT feeding, contained 380 parts per million of DDT, and her milk 7 parts per million, indicating storage and residual effect. It should be emphasized that this cow received much larger amounts of DDT than would be probable under practical conditions.

A small lot of silage was available from a field-dusted experimental field. This was found to contain less than 1 part per million of DDT when fed, and no DDT was found in the milk of the cows to which it was fed.

THYROPROTEIN, PROTEIN AND MINERALS

P21. Thyroid Secretion Rate of Growing, Pregnant, and Lactating Rats. R. A. MONROE AND C. W. TURNER, Missouri Agricultural Experiment Station.

In this study, a quantitative determination has been made of the thyroid

secretion rate of growing male and female rats (fifty to three hundred grams) and of pregnant and lactating rats. The rate of thyroid secretion was measured by the technique suggested by Dempsey and Astwood in 1943. The principle of the method, in brief, is this: The amount of thyroxine is determined which, by daily injection, will prevent thyroid hypertrophy in thiouracil-treated rats. This amount is considered to be equivalent to the amount of thyroid hormone the rat would produce normally. The daily thyroid secretion rate in all groups in this study, therefore, is expressed in terms of micrograms of d,l-thyroxine per hundred grams of body weight.

The thyroid secretion rate of the growing male rats showed no significant change throughout the body weight range; the average daily rate of secretion in all groups was approximately 3.5 micrograms per hundred grams of body weight. The growing females, on the other hand, showed a steady decline in thyroid secretion rate as their body weight increased. The most marked decline was noticed between the range of fifty to two hundred grams body weight, when the secretion rate of the thyroids dropped from over 4.5 micrograms to slightly over 3.0 micrograms per hundred grams body weight. From this point on, the rate of decline was slower. In the two hundred and fifty to three hundred gram weight group (ave. 266.2 gm.), the thyroid secretion rate had declined to 2.82 micrograms per hundred grams body weight.

The data concerning the thyroid secretion rate of pregnant rats show no significant variation from that of normal female rats of the same body weight. Likewise, lactating rats also seem to have a thyroid secretion rate which does not vary from normal.

In addition to the data presented above, we have figures which seem to prove conclusively that, while thiouracil does pass through the mammary gland in considerable quantities, thyroxine does not pass through into the milk, even in doses above the physiologic level. Nor is the growth rate of the young rats affected, in the first fifteen days at least, by the administration of thiouracil and/or thyroxine to the mothers.

P22. Some Physiological Effects of Feeding Thyroprotein to Dairy Cows. L. A. Moore, Division of Nutrition and Physiology, Bureau, of Dairy Industry, Agricultural Research Administration, United States Department of Agriculture.

Some rather significant physiological observations have been made in an experiment where thyroprotein is being fed to milking cows for periods as long as eight months. When T.D.N. was fed according to the Morrison standard marked losses in body weight were noted. After considerable loss in body weight, milk production declined at a fairly rapid rate. The loss in body weight and decline in milk production could be checked by increasing the T.D.N. intake by 25 per cent above the Morrison standard.

It has further been noted that after cows have been receiving thyroprotein for four to eight weeks and there has been considerable loss in body weight and milk production has declined sharply, the heart rate will also decline. When the feed intake is then increased 25 per cent the heart rate is also increased. It would appear that the heart rate is governed by the amount of energy the body has available, whether from the body tissues or from feed or both. These observations must be considered preliminary and further data on these points are being gathered.

P23. The Influence of a Synthetic Thyroprotein when Fed to Dairy Cows over an Extended Period of Time. RALPH P. REECE, New Jersey Agricultural Experiment Station, New Brunswick, N. J.

Nine dairy cows received daily either 10 or 15 grams of thyroprotein in their grain ration for periods of time varying from 3 months to 17 months. Three of the 4 cows initially fed 10 grams of thyroprotein showed an increase in milk production and 4 of 5 cows initially fed 15 grams of thyroprotein showed increases in milk production. Soon after the feeding trial started 8 of the 9 cows secreted milk with a higher fat content than might have been expected otherwise. For the entire length of the feeding period 6 of the 9 cows secreted milk with a higher fat content than that secreted in a similar segment of either a previous or a subsequent lactation period. Six of the 9 cows produced more milk and 3 produced less milk during the thyroprotein feeding period than that secreted in a similar segment of either a previous or a subsequent lactation period. Of the three cows not showing an increase in milk production during the entire thyroprotein feeding period only one failed to show an initial response in milk production.

P24. Effect of Feeding Iodinated Casein to Dairy Cows on the Protein Composition and Content of Milk. A. H. VANLANDINGHAM, GEORGE HYATT, JR., AND CHAS. E. WEAKLEY, JR., West Virginia Agricultural Experiment Station, Morgantown, West Virginia.

Previous data obtained at this Station and elsewhere show clearly that active iodinated casein (thyroprotein) when fed to dairy cows caused an increase in the fat content of the milk. Only relatively small changes in the solid-not-fat have been observed.

During the winter and spring of 1946 iodinated casein supplied by the Cerophyl Laboratories, Kansas City, Missouri, was fed to a group of three Jerseys and four Holstein cows to study the effect of iodinated casein on the protein content and composition of milk. Changes in the composition of milk proteins are of particular interest because of the relationship of such changes to the development of mastitis. The Jerseys were fed 10 to 15 grams and Holsteins 15 to 20 grams daily. Feeding was begun from two and one-half to three months after calving.

Composite samples of milk collected one day each week from individual cows fed iodinated casein and from a similar group of control cows not receiving iodinated casein were analyzed for total nitrogen by the Kjeldahl method. Casein was precipitated and nitrogen determined in the filtrate as non-casein nitrogen as described by Rowland (J. Dairy Res., **9**: 42, 1938). Fat was determined on composite samples twice each week. Changes in heart beat, respiration rate, body weight, and body temperature were observed weekly.

Results obtained show clearly that the feeding of iodinated casein resulted in an increase in the rate of heart beat, respiration rate, milk and fat production and per cent of fat in milk.

Results also show no appreciable change in the total nitrogen, casein nitrogen or non-casein nitrogen in the milk due to the feeding of iodinated casein.

However, definite increase in the total nitrogen, non-casein nitrogen and the proportion of non-casein nitrogen to the total nitrogen in milk was observed in cases of clinical mastitis. Clinical mastitis was observed among cows in the herd which did not receive iodinated casein as well as some of those which received iodinated casein.

P25. The Influence of Feeding Synthetic Thyroprotein on Fertility of Bulls. A. B. SCHULTZE AND H. P. DAVIS, University of Nebraska, Lincoln, Nebraska.

As a preliminary experiment to determine the effect of feeding thyroprotein on fertility, seven bulls including two Jersey, one Milking Shorthorn, one Guernsey and three Holstein, were fed from 1.00 to 1.24 grams of thyroprotein per 100 pounds body weight for a period of thirty days. Observations on initial motility, maintenance of motility during storage at 40° F., and the percentage of abnormal sperm were made. The relative fertility of the semen samples was evaluated by determining the percentage of conceptions resulting on the first and second inseminations in artificial breeding associations. Quality of semen and conception rates were determined for 30 semen samples from the seven bulls prior to feeding thyroprotein and for 27 samples during and 10 days after the feeding of thyroprotein for 30 days. The 30 semen samples collected prior to the feeding of thyroprotein were used in 604 inseminations. The 27 semen samples obtained during and 10 days after the feeding period were used in 586 inseminations.

The initial motility of the 30 samples from the seven bulls prior to thyroprotein feeding averaged 67% compared to 72% during the time thyroprotein was fed. Motility was maintained at an average of 28% at 5 days storage at 40° F. for samples collected prior to the feeding period compared to 40% at 5 days storage for the samples collected during the time thyroprotein was fed.

There was little average change between the percentage of abnormal sperm before and the percentage during the feeding of thyroprotein except in the case of one bull whose semen contained a high percentage (45%) of abnormal sperm before the feeding period. During the time thyroprotein was fed, the percentage of abnormal sperm declined to 20% in this case. However, this particular bull's fertility was not influenced to any significant degree as judged by conception percentages obtained in the field.

With respect to the relative fertility (conception rate) of semen samples collected before and during the feeding of thyroprotein, of the seven bulls used in the experiment, there were 5 whose fertility was increased by feeding thyroprotein. The fertility of the other two bulls was not affected.

With respect to the 5 bulls whose fertility was increased, there was an increase from an average conception percentage of 51.7 before feeding thyroprotein to an average of 55.7 per cent during the 30-day feeding period. A more detailed analysis of the results with these 5 bulls showed that in every case where a semen sample was taken within 7 to 10 days after the beginning of feeding thyroprotein, a lowered conception rate (38% average for 4 samples) resulted. Following this first 10-day period or from 10 to 30 days after the beginning of feeding thyroprotein, there was an increase in fertility. Nineteen semen samples from the 5 bulls showed an average of 58.6 per cent conception rate during this 10–30-day period or a 6.9% increase in conception percentage over the rate obtained during the period prior to feeding thyroprotein. Statistical analysis of these differences showed them to be significant.

Four semen samples taken within 10 days after the feeding of thyroprotein was stopped resulted in increasing the conception rate to 60.4% compared to the 58.6% obtained during the last 20 days of the feeding period.

As a control against any influence that season may have had on fertility, the breeding efficiency of 7 bulls not fed thyroprotein at any time was determined. There was no change in the breeding efficiency during the time of the experiment with these control animals.

P26. Utilization of Non-Protein Nitrogen by Dairy Heifers. I. R. Jones and J. R. Haag, Oregon State College.

This is a progress report of studies begun in 1944 to determine the possible relationship of the sulfur content of feedstuffs to the utilization of non-protein nitrogen by dairy animals. To date, records are available on 32 heifers ranging in age at the start of the feeding period from 150 to 494 days. The heifers, all purebred, have included 18 Holsteins, 8 Jerseys, and 6 Ayrshires, and were paired into two groups on the basis of breed, age, and weight.

The first group of three pairs was fed for 172 days, the second group of 2 pairs for 86 days, and the third group of 11 pairs for 133 days.

The first group was fed bleached oats and vetch hay containing 4.07% crude protein and 0.065% sulfur and a grain mixture with 60% oats, 30% wheat, 7% urea, 2% bonemeal, 1% iodized salt, and 0.2% irradiated yeast. This mixture contained 21.8% crude protein and 0.129% sulfur. The grain mix fed to one of each pair was supplemented with 1% sodium sulfate. The grain mixture with 7% urea was rather unpalatable at the three-pound level fed daily, hence the amount of urea was reduced to 3% of the grain mixture and 5% of peanut meal was added. The second group of calves received the 3% urea grain mix and hay from the same lot. Each calf received 2 or 3 cc. of a 10,000-unit vitamin A oil daily.

The average daily gains for the first group of animals with sulfur supplement were 1.73, 1.61, and 1.83 pounds and for their paired mates without sulfur, 1.63, 1.39, and 1.12 pounds, indicating good utilization of the nitrogen in urea, inasmuch as the hay and grain mixture without urea supplied only 6.2% crude protein.

The average daily gains of the second group of heifers were 1.97 and 1.60 for the sulfur pair and 1.90 and 1.71 for their mates.

The third group of heifers were fed oats and vetch hay containing 6.96% crude protein and 0.066% sulfur. The grain mix contained 60% oats, 17% barley, 10% alfalfa meal, 5% linseed meal, 3% urea,, 2% each of bonemeal and iodized salt, 1% irradiated yeast, and analyzed 18.5% crude protein equivalent and 0.13% sulfur. As previously, 1% sodium sulfate was added to the grain mixture for one of each pair of calves. As consumed by the individual calves, the ration supplied approximately 10% crude protein of which 2.4% was derived from urea.

The average daily gain for 7 Holstein heifers fed the sulfur ration was 1.63 pounds daily and for their purebred mates, 1.58 pounds; for 4 Jerseys fed sulfur 1.09, and their mates 0.90 pounds. The growth of the calves has been on the order of 20% to 30% below normal for their age and breed and, while urea utilization is indicated and 8 of 11 pairs of heifers favored the sulfur supplement, further proof is needed before conclusions can be drawn.

P27. Shark Meal as a Protein Supplement in Dairy Calf Rations. SIDNEY P. MARSHALL,* R. B. BECKER, AND G. K. DAVIS, Fla. Agr. Expt. Sta., Gainesville, Fla.

Shark meal is a relatively new protein supplement produced by reducing shark carcasses after the liver, hide, fins, and sometimes fillets, teeth, and jaws are removed. The output of shark meal manufactured in Florida and along the Pacific seaboard has increased to considerable proportions during the past 6 years.

Analyses of 19 samples of shark meal prepared by a wet-process method averaged 78.07 per cent of crude protein. Seventeen samples averaged 1.75

* Now at Clemson Agr. College, Clemson, S. C.

per cent of urea and 0.49 per cent of nitrogen of a non-protein fraction other than urea. Non-protein nitrogen in these forms is equivalent to 8.17 per cent of crude protein.

It is generally agreed that carnivorous and omnivorous animals are unable to utilize some forms of non-protein nitrogen. The ability of ruminants to utilize some non-protein nitrogen indicates that cattle should be able to use the total nitrogen of shark meal efficiently.

To evaluate shark meal as a protein source for young dairy calves, it was compared with roller process powdered skim milk in the rations of Jersey females from 8 through 24 weeks of age. To basal rations composed of ground prairie hay, citrus molasses, ground yellow corn, ground oats, and a mineral mixture, the necessary amounts of shark meal or of powdered skim milk were added to bring the crude protein level to 14 per cent. Corn starch was added to the shark meal rations to adjust the quantity of nitrogen contributed by this protein supplement per pound of total feed to equal that per pound of total feed supplied by powdered skim milk to the other rations. The experiment was divided into 4 periods of 4 weeks each. The rations fed contained 35 per cent of ground prairie hay during the first period, 40 per cent during the second, 45 per cent during the third, and 50 per cent during the fourth. Thirty milliliters of shark liver oil containing approximately 9,000 International units of vitamin A per gram were fed each calf weekly. Feed consumption was equalized between each of the 6 pairs of calves by using the Paired Feeding Technique.

Both of the rations were palatable and the quantities of feed offered were governed with equal frequency by calves on the different rations. The animals fed shark meal rations made an average gain of 118.4 pounds in body weight and 16.3 centimeters in height at withers. The pair mates, fed powdered skim milk rations, gained 117.1 pounds and increased 15.9 centimeters in height. This difference in gain in body weight and increase in height at withers was not significant at the 5 per cent level (Snedecor, 1938). The average rate of growth was slightly below the normal for Jersey females reported by Ragsdale (Mo. Agr. Expt. Sta. Bul. 336, 1934).

P28. Ground Mungbeans as a Protein Supplement in Rations for Dairy Cows. A. H. KUHLMAN, W. D. GALLUP, AND H. W. CAVE, Oklahoma A. and M. College.

Several varieties of the mungbean (*Phaseolus aureus*) have been grown in Oklahoma to a limited extent for about twenty years. During most of this period this annual legume was used as a soil builder and as a hay and silage crop. When importation of mungbeans from China and other parts of Asia for food purposes was interrupted during the recent war, Oklahoma farmers became interested in growing green mungbeans on an extensive scale for sprouting purposes. In 1942, Oklahoma farmers planted 15,000 acres in

mungbeans; in 1943, 45,000 acres; and in 1945, 169,000 acres of which 110,000 acres were harvested for seed. This crop yielded 24,200,000 pounds of seed. Even when most of the seed is suitable for food purposes, considerable amounts of cracked and cull beans are usually available for feeding purposes.

Since mungbeans usually contain about 23 to 25 per cent total protein, 2 to 3 per cent oil and 56 to 60 per cent N-free extract, it seemed probable that they might be used to replace a part of the cottonseed meal ordinarily fed in dairy rations.

Two 90-day feeding trials, each consisting of three 30-day periods conducted on the double reversal plan and including a total of 25 cows, have been completed to determine the value of ground mungbeans as a protein supplement in dairy rations. Prairie hay of good quality was used as the sole roughage in each trial. It was fed in such amounts to each cow that the total digestible nutrients furnished by the hay were equivalent to her daily maintenance requirements. Concentrates were fed according to the Morrison Feeding Standard for milk production with adjustments made at seven- to ten-day intervals on the basis of the daily weight records of each cow to secure slight but similar gains on the rations used.

The control concentrate mixture consisted of 350 pounds ground No. 2 yellow corn, 200 pounds ground oats, 200 pounds wheat bran, 250 pounds cottonseed meal (41 per cent protein) and 10 pounds each of salt, ground limestone and bonemeal. In the experimental concentrate mixture, 300 pounds of ground mungbeans replaced 150 pounds of ground corn and 150 pounds of cottonseed meal in the control mixture. Each mixture contained slightly less than 19 per cent protein.

In each of the two trials which have been completed, almost identical results were obtained from the control and the experimental rations. Since 300 pounds of mungbeans replaced 150 pounds of corn and 150 pounds of cottonseed meal, 100 pounds of mungbeans were equivalent to 50 pounds of corn and 50 pounds of cottonseed meal in feeding value. Mungbeans replaced 60 per cent of the cottonseed meal and almost 43 per cent of the corn used in the control mixture.

Very satisfactory seed crops of 12 to 15 bushels per acre are often obtained when mungbeans are planted in June or early July following a small grain crop. Mungbeans, therefore, can be grown as an emergency crop and used as a source of protein in dairy rations.

P29. A Progress Report of a Study of the Effects of Manganese on Calcium Metabolism in Lactating Dairy Cows. J. T. Reid, K. O. Pfau, R. L. Salsbury, and C. B. Bender, Rutgers University.

Three weekly balance trials were conducted at regular intervals with each of 8 Holstein and 4 Guernsey cows during the first 150 days of lacta-

tion. The 12 animals comprised 3 collection groups and 4 feed groups. The feed groups received the following: Group I, basal ration (consisting of ground corn, 30 parts; rolled oats, 30 parts; linseed oil meal, 28 parts; wheat bran, 11 parts and plain salt, 1 part); Group II, basal ration + $CaCO_3$, (C.P.) reagents; Group III, basal ration + $CaCO_3$ and $MnSO_4$, (both C.P. reagents); Group IV, basal ration + Mico.* All animals received corn silage and timothy-clover hay.

The calcium balances of the four groups were as follows: IV > II > I > III; whereas, according to the percentages of calcium utilized, the groups ranked I > IV > II > III. A marked depression in calcium retention was found in the animals receiving the $CaCO_3$ + $MnSO_4$ supplement as compared to the other groups, which may be attributed to the manganese sulfate. Group IV, receiving the additional trace elements, showed a distinct advantage in the maintenance of a positive calcium balance over the groups receiving the other supplements.

The earlier work showing that cows utilize calcium more efficiently when fed a low calcium ration than when the ration is high in calcium and that the retention is also governed by the animal's demand for calcium was substantiated in this study.

No appreciable differences were found in the hemoglobin content, red blood cell counts, red blood cell volumes, the concentrations of plasma proteins, calcium and inorganic phosphorus of the 4 groups.

FEEDING AND MANAGEMENT

P30. Needed Dairy Feed Ingredient Research. RAYMOND T. PARKHURST, Flory Milling Co., Inc., Bangor, Pennsylvania.

During the periods of shortages in recent years, most feed manufacturers and mixers have not had sufficient information concerning several new ingredients offered to know at what levels they could be used, if at all.

This paper will offer for discussion data concerning several ingredients about which more information is needed and which offer possibilities as either emergency or regular constituents of dairy feeds.

P31. Ground Ear Corn as Compared to Ground Shelled Corn in a Simple Grain Mixture for Milk Production. C. F. MONROE AND W. E. KRAUSS, Ohio Agricultural Experiment Station, Wooster, Ohio.

A simple grain mixture containing ground ear corn was compared to one containing ground shelled corn. In addition to the corn both contained soybean oil meal, with 2.5 per cent more being added to the ground ear corn mixture in order to equalize the protein content of the two mixtures.

* Mico, manufactured by the Limestone Products Corporation of America, Newton, New Jersey, consists of calcite flour fortified with Mn, I, Co and Cu.

Comparable amounts of salt, steamed bone meal, and limestone were included in the two mixtures.

Corn silage was fed at rate of 30 pounds daily per cow. Legume-mixed hay was fed in liberal amounts, but it was not weighed.

Two reversal feeding trials of 100 days each were conducted. Seventy Holstein cows, fed and milked three times daily, were used in the work. Of this number 16 participated in both trials. The data for these cows are considered as a third trial.

The three trials are in general agreement. Milk and butterfat production were a little higher on the ground shelled corn mixture. In terms of 4 per cent milk the production on the latter amounted to 98.83, 98,29 and 98.62 per cent of the former in the three trials, respectively. An analysis of the productions following the reversing of the feeding at the end of the first period in each trial confirms the above findings.

There were no marked differences in liveweight gains on the two mixtures.

The butterfat tests were apparently not affected by the form in which corn was fed.

A replacement value for ground ear corn (or cobs) in terms of ground corn cannot be determined because of the additional amount of soybean meal in the ground ear corn mixture and because the amounts of hay consumed are not known.

The financial returns were a little higher on the ground ear corn mixture than on the ground shelled corn mixture. The difference as calculated according to prices prevailing in 1946, amounted to 48 cents per month per cow.

It is concluded on the basis of this work that the common practice of feeding ground ear corn rather than ground shelled corn is justified.

These trials furnish additional evidence on the possibility of using the simple grain mixture. The 16 cows that were in the two trials from November 1 to May 8, a period of 190 days, averaged 42.9 pounds of milk daily. On a 30-day basis they averaged 1287 pounds of milk and 42.23 pounds of butterfat. Likewise, the production of the other 54 cows used in this work represents 100 days of continuous feeding. The average production of these cows was almost 47 pounds of milk daily.

P32. Ten Years Evaluation of Bluegrass Pasture.* H. B. Morrison and Fordyce Ely, Kentucky Agricultural Experiment Station, Lexington, Kentucky.

Dairy heifers (Holstein and Jersey) were used to graze an 11.6-acre

* The investigation reported in this paper is in connection with a project of the Kentucky Agricultural Experiment Station and is published by the permission of the Director.

bluegrass pastures at Lexington, Kentucky, during the 1936 to 1945 seasons, inclusive. No other feed was provided them while on pasture, except salt and bonemeal. The heifers were weighed on three consecutive days at two-week intervals. The pastures were grazed as closely as possible without overgrazing. Heifers were added or removed when necessary following each bi-weekly weighing period, in accordance with the conditions of the pasture.

Pasture yields are expressed in pounds of T.D.N. per acre. An allowance of 3.53 pounds of T.D.N. was made per pound of gain and 2.73 pounds deducted per pound loss in weight of the heifers. Credit for maintenance was calculated at the rate of 7 pounds of T.D.N. per 1000 pounds weight per day.

The length of the pasture season varied from 168 to 224 days and averaged 195 days.

The average yields of T.D.N. per acre by months (extremes in parentheses) were as follows: April 195 (0–626), May 535 (346–717), June 464 (278–633), July 295 (82–484), August 291 (117–432), September 263 (104–481), October 162 (0–378) and November 20 (0–72).

The highest yield per acre of T.D.N. in a season was 2786 pounds (in 1938), the lowest 1343 pounds (in 1936), and the 10-year average yield was 2226 pounds T.D.N. per acre.

The average yield per acre of this pasture (2226 pounds T.D.N.) is the equivalent of the T.D.N. furnished by 49.5 bushels of corn or 2.2 tons of alfalfa hay. The labor involved in production of this pasture was far less than that involved in the production of corn or alfalfa hay, while the T.D.N. yield of the pasture is fairly comparable with that of corn and alfalfa hay in this vicinity.

P33. Silage from Drought-Damaged Corn. C. F. Monroe, A. E. Perkins, C. E. Knoop, and Louise Skinner, Ohio Agricultural Experiment Station, Wooster, Ohio.

Corn silage made from drought-damaged corn was found to have approximately the same chemical composition and feeding value as a silage made from "normal" corn. Apparently the unfavorable growing conditions had resulted chiefly in a reduction in total yield and in the quantity and quality of the ears produced. Although the so-called "normal" corn was not up to the usual standard, it had been less affected than the other corn, probably as a result of a difference in the soil conditions.

A large percentage of the ears on the drought-damaged corn was denuded of husks at the tips. On many of these ears a fungus identified as *Fusarium moniliforme* was present, together with an infestation of black beetles and small larvae of the species *Carpophilus lugubris* Murr. There was some question regarding the effect of these conditions on the quality of the silage.

In a feeding trial with milking cows the two silages appeared to be equally palatable. The experimental feeding plan called for a near minimum use of hay and grain with a maximum use of silage. Under these conditions no significant differences in the production from these two silages was shown.

P34. The Unknown Lactation Factors in Corn Silage. C. F. HUFFMAN, S. T. DEXTER, AND C. W. DUNCAN, Michigan Agricultural Experiment Station, East Lansing.

Lactating cows fed alfalfa hay alone become depleted in unknown lactation factors. The replacement of a part of the T.D.N. with an equal amount of T.D.N. in grain results in an increase in the production of 4 per cent fat-corrected milk. Grains such as corn and wheat furnish factors which are lacking in the hay. Corn silage made from varieties of corn grown for grain contains considerably more grain than ordinary corn silage. Silage made from this variety of corn is in reality a mixture of corn stalks and corn grain.

In the first experiment corn silage made from an ear corn variety ensiled at the early dent stage was used as a partial replacement of hay in the ration of the depleted cows. When the replacement was made with hay and corn silage so that the T.D.N. was equal to or less than with hay alone there was a 19 per cent increase in 4 per cent fat-corrected milk. In 10 comparisons there was a 24 per cent increase in fat-corrected milk per pound of T.D.N. when a part of the hay was replaced by corn silage. There was also a 41 per cent increase in fat-corrected milk produced per pound of dry matter.

The data indicate that the grain in corn silage should be considered in calculating the amount of grain to be fed to milking cows. The use of the same "thumb" rules for feeding with or without corn silage may result in the overfeeding of grain when corn silage is fed.

In a second experiment, silage from corn with very few ears was compared with silage from an ear-producing variety of corn for milk production. The ear-corn silage was superior to the silage-corn silage for milk production on the dry basis.

P35. A Preliminary Report on the Study of Factors Influencing Rumen Microflora. A. L. BORTREE, K. M. DUNN, R. E. ELY, AND C. F. HUFFMAN, Michigan State College.

Microscopic counts were made of the microflora of the rumen contents of dairy animals to determine the effect of various feeds on the numbers of microorganisms present.

Rumen samples were taken prior to feeding and at two-hour intervals after feeding for periods of ten to twelve hours. The samples were preserved in formalin, stained with Gram's iodine, and counted in a Petroff-Hausser counting chamber. Only the larger microorganisms which stained

deep blue with iodine were counted; therefore the results reported do not necessarily reflect the changes in the total population.

The results which have been obtained to date indicate that there is a rapid increase in the numbers of these organisms present in the rumen within two hours after the animals have been fed and that these high counts are maintained or increased for several hours and then gradually return to the range observed prior to feeding.

The quality of the roughage fed appeared to influence the bacteria counts somewhat but the changes were not marked. Likewise when the animals were changed from hay to pasture the changes in the counts were not great.

When three pounds of glucose was given in addition to the usual feeding of hay, the counts were about 100 per cent greater than those observed for hay alone. The administration of starch under similar conditions produced results which were only slightly different from those obtained with hay alone.

P36. The Physiological Role of the Rumen of the Young Bovine as Indicated by the Growth and Blood Composition of a Rumenectomized Calf. G. H. WISE, R. P. LINK, W. W. THOMPSON, AND M. J. CALDWELL, Kansas Agricultural Experiment Station, Manhattan.

Rumenectomy was employed as an indirect means of determining the nutritional role of the rumen in the young calf. This organ was removed at the rumeno-reticular groove, using a technique similar to that developed by the Pathology Department of the Ralston Purina Company (*private communication*). The operation was preformed on four calves, two of which succumbed to post-operative shock. The remaining two were maintained under standard dietary and managerial regimes until the health of the calves indicated the need of corrective measures.

One of the calves developed normally, manifesting no ill effects except a marked tendency to bloat, particularly when grazing spring grasses. The chronic nature of the case suggested an impairment of the rumen activity. Autopsy of the sacrificed calf revealed marked regeneration of the rumen, which was normal in total size but malformed and deficient in the posterior region including the dorsal and ventral sacs.

The second calf manifested no abnormalities during the two months immediately following the operation but subsequently became increasingly unthrifty, revealing a waning appetite and a marked retardation of growth. Hematological examination of the blood disclosed marked anisocytosis and poikilocytosis, and analysis of the serum indicated avitaminosis A. Vitamin A therapy increased the level of this constituent in the blood but failed to alter any of the other abnormalities. Subsequent daily administrations of ruminal fluids stimulated the appetite, accelerated growth, increased the

vigor, improved the general appearance and reduced the number of poikilocytes of the blood.

After 74 days, the foregoing therapy was replaced with spring pasture. The weight gains were greatly reduced but otherwise the calf continued to improve. The reduction of gains probably was the consequence of inadequate energy intake, since the feed capacity of the stomach appeared to be subnormal.

The increased appetite seemed to stimulate redevelopment of the rumen as evidenced by increased distention and by the initiation of rumination. The appearance of considerable undigested material in the feces, when the initial increase of the appetite was noted, indicated abnormal digestion. This was gradually ameliorated, presumably as a result of rumen development.

These observations further emphasize the recognized role of the rumen in the formation of products essential for the maintenance of the health of the calf.

P37. Effect of High Humidity and High Temperature on Dairy Cows. D. M. Seath and G. D. Miller, Louisiana Agricultural Experiment Station.

Observations made of Holstein and Jersey cows during the summers of 1944 and 1945 showed that changes in air temperature were the major cause for changes in both body temperature and respiration rate of milking cows. A statistical analysis of the data indicated that a change of one degree in air temperature had from 13 to 15 times as much influence on body temperature as did one per cent change in relative humidity. Likewise, one degree change in air temperature affected respiration rate 41 to 43 times as much as did a one per cent change in humidity.

Partial correlations between air temperature and body temperature (humidity held constant) were 0.674 and 0.534 for the two years; whereas, relative humidity with body temperature partial correlations (air temperature constant) were 0.16 and 0.10. On this same basis air temperature and respiration independent of humidity had partial correlation of 0.748 and 0.353, while humidity and respiration rate (with air temperature constant) had only very small negative correlations, – 0.06 and – 0.02.

Air temperature and pulse rate independent of humidity had only small partial r values, 0.195 and 0.159. Humidity and pulse rate independent of air temperature had insignificantly small r values, *i.e.*, – 0.05 and 0.07.

P38. The Causes and Extent of Variations in Weight of Dairy Cows Weighed at Half-hour Intervals over Ten-day Periods. N. N.

ALLEN, Vermont Agricultural Experiment Station (Now at University of Wisconsin).

In order to study the causes and extent of fluctuations in live weight, dairy cows and heifers were weighed at half-hour intervals over periods of ten days, with detailed accounting for their intake of food and water, and outgo of feces, urine, and milk. This was accomplished without disturbing the usual routine of the animals by confining them to stalls mounted on the platforms of scales. Five milking cows, 3 dry cows and 2 heifers were included.

The milking group averaged 990 pounds live weight; 62.8 pounds of feces and 16.3 pounds of urine eliminated; and 28.2 pounds of milk produced daily.

The non-milking group averaged 1043 pounds live weight; and 40.4 pounds of feces and 12.1 pounds of urine eliminated.

The milking group consumed an average of 51.0 pounds of feed and 85.3 pounds of water daily, as compared to 39.2 pounds of feed and 40.0 pounds of water for the non-milking group. The unaccounted-for loss averaged 29.4 pounds for the milking group and 26.6 pounds for the non-milking group.

While the heavier milkers showed a much wider range of variation in weight within the day due to greater feed and water consumption, and correspondingly greater weight losses, the trends of the changes were very similar. The lowest weights were recorded quite uniformly at the 5 o'clock weighings immediately prior to feeding, with little choice between the morning and evening low values. The range of the day-to-day variation was narrowest at the time when the weight was lowest. The maximum average weight within the day occurred 2½ hours after the evening feeding. While the same amount of feed was consumed in the morning, more time was taken to eat it, and the offsetting losses were greater, consequently the weight did not reach as high a peak.

There were four times each day when a single weighing accurately represented the average for the day. Two of these occurred shortly after the two feedings when the weight was increasing rapidly. The other two occurred during the periods of declining weight when the rate of change was slow. Because of the slow rate of change, the weighing time should be selected during the declining phase to secure a weight with average fill. Under the conditions of this experiment, 1:00 A.M. and 11:30 A.M. were the points at which the average was reached.

These data suggest that careful thought should be given to the time and manner of weighing, keeping in mind the purpose for which the weights are to be used.

HAY

P39. Standardizing Hay Palatability Trials with Calves. H. S. WILLARD, Agricultural Experiment Station, University of Wyoming, Laramie, Wyoming.

A study of the hay consumption of 34 Holstein calves from 3 to 12 months of age showed that consumption followed hay allowance over a wide range of weight and age. When hay allowance was increased by one pound daily the coefficient of variation in consumption of three types of hay ranged from 1 to 3 per cent, the standard deviation ranged from 0.4 to 0.8 and the standard error between 0.05 to 0.2.

This study indicated significant variations in consumption of individual calves. Additional variations of individual calves were revealed in a study of the consumption of 1st and 2nd cutting alfalfa fed over a 10-day period to six calves each of different weight. A high, but not significant, correlation was shown between live weight and hay consumption.

Rules are formulated for standardizing palatability tests which should give comparable results year after year.

P40. Comparative Value of Alfalfa, Mixed Grass and Legume, and Timothy Hays for Young Dairy Cows. C. L. NORTON, Department of Animal Husbandry, Cornell University, Ithaca, New York.

Continuous feeding trials were conducted for the purpose of determining the comparative feeding value of alfalfa, mixed grass and legume, and timothy hays. Three experimental groups of 8 Holstein heifer calves each were used. The experimental period was from birth to 20 weeks of age.

The calves were raised according to the Cornell limited whole milk and dry calf starter system. A total of 350 pounds of whole milk was fed to weaning which was at 7 weeks of age. Calf starter was fed free choice up to a maximum consumption of 4 pounds per head daily. Hay was fed ad libitum and weighbacks were taken daily.

As the calves were born they were assigned in rotation to the various treatments. A total of 24 calves was used in the experiment.

A summary of the growth and feed consumption was made at the end of 20 weeks. Expressed in terms of per cent of Ragsdale's normal, the gain from birth to 20 weeks of age for the calves fed the three hays was as follows: Alfalfa, 108.1 per cent; mixed grass and legume, 102.4 per cent; and timothy, 95.7 per cent. The apparent differences in rate of gain were not statistically significant.

Although the differences in the consumption of calf starter from birth to 20 weeks of age were not significant statistically, a definite trend was suggested. It was observed that the calves receiving timothy hay and mixed grass and legume hay ate starter at the maximum rate more quickly than the

calves receiving the alfalfa hay. Greater differences might have been obtained if the calf starter intake had not been limited to 4 pounds per head daily. The groups ranked in the following order on the basis of total calf starter consumed: Timothy, 339.5 pounds; mixed grass and legume, 391.8 pounds; and alfalfa, 368.8 pounds.

There were large, rather consistent differences among the three groups in the total consumption of hay up to 20 weeks of age. The groups ate the following amounts of hay during the experimental period: Alfalfa, 492.4 pounds; mixed grass and legume, 421.3 pounds; and timothy, 326.0 pounds. These differences were statistically significant.

The data indicate that there was an inverse relationship between the amount of hay consumed and the amount of calf starter eaten. The calves receiving alfalfa hay ate the most hay and the least calf starter of the three groups. The calves receiving timothy hay ate the least hay and the most calf starter.

P41. Feeding Barn Dried Hay to Dairy Heifers. C. E. WYLIE, JOHN EWING, AND S. A. HINTON, University of Tennessee.

Great advances have been made in the use of the barn hay drier as a means of improving the quality of hay, and in saving more hay. Little work has been done in testing the feeding value of this hay with dairy animals. In order to check on the growth of Jersey heifers fed barn dried hay, feeding trials were set up by the Tennessee Experiment Station at Knoxville and Columbia. The rations were as follows: Group I—Long field cured alfalfa hay ad lib. Group II—Long barn dried alfalfa hay ad lib. Group III—Chopped barn dried soybean hay ad lib.

The heifers were fed hay in groups with records kept of the weights of hay put into the manger and hay rejected. The original hay was graded and chemically analyzed. Rejected hay was chemically analyzed.

The growth of the heifers was checked by weights and heart girth measurements, and compared with normal growth.

The heifers seemed to make normal growth and to be thrifty in appearance. The details of feed consumption and growth are shown in table form. As the amount of hay was increased in the manger, the rejected hay increased in amount. When the feeding level was so low that little feed was rejected, the intake was below the (Morrison) feeding standard.

P42. Comparative Efficiency of Three Methods of Harvesting and Preserving Forage Crops. R. E. HODGSON, J. B. SHEPHERD, L. G. SCHOENLEBER, H. M. TYSDAL, AND W. H. HOSTERMAN, Division of Nutrition and Physiology, Bureau of Dairy Industry, Divisions of Engineering and Forage Crops and Diseases, Bureau of Plant Industry, Soils and Agricultural Engineering, Agricultural Re-

search Administration; and the Grain Products Branch, Production and Marketing Administration.

Alfalfa was made into wilted alfalfa silage, barn-cured hay and field-cured hay to compare the relative efficiency of the three methods of harvesting. The alfalfa was cut when one-tenth to one-fourth in bloom and harvested in the three ways simultaneously. Both the first and second crops were so harvested. Except for about one-half of the first cutting field-cured hay, the alfalfa was put up without rain. Records were kept of the labor and machinery required to harvest the crops and the losses in dry matter and nutrients and the changes in the composition of the forages were determined. The three forages were fed to milking cows to compare their values for milk production and the effect on the vitamin A value of the milk.

No appreciable differences were observed in total man hours or machinery hours required for harvesting when compared on the basis of a ton of dry matter saved for feeding. The wilted silage method was the most efficient of the three in conserving dry matter, protein and carotene for feeding. The barn curing method was the next most efficient. Of the original yields of dry matter, 80 per cent and 86 per cent were available for feeding when the first and second cutting were made into silage; 80 per cent and 79 per cent respectively when they were made into barn-curd hay; and 69 and 77 per cent respectively when they were made into field-cured hay. Of the original yields of protein in the second cutting, 84 per cent was saved for feeding with the silage method; 79 per cent with the barn-curing method; and 70 per cent with the field-curing method. The silage contained 12.7 per cent more protein and the barn-cured hay contained 9.6 per cent more protein than the field-cured hay.

The carotene in the dry matter of the first cutting used for silage averaged 278 micrograms per gram when cut, 239 when ensiled and 156 when fed; that barn-cured averaged 286, 143 and 50 respectively when cut, when put on the drier and when fed; and that field-cured averaged 270, 58 and 9 respectively when cut, when stored and when fed. The carotene in the dry matter of the second cutting used for silage averaged 308 micrograms per gram when cut, 218 when siloed and 82 when fed; that barn-cured averaged 303, 122 and 22 when cut, when put on the drier and when fed; that field-cured averaged 302, 50 and 12 when cut, when stored and when fed.

The first cutting wilted alfalfa silage fed with corn silage and concentrates caused cows to produce butterfat containing over 18,000 I.U. of vitamin A per pound continuously throughout a 110-day winter feeding period. Other similar cows fed U. S. No. 2 leafy alfalfa with corn silage and concentrates produced butterfat that after 20 days averaged 16,533 I.U.; after 50 days, 12,450 I.U.; after 80 days 9,927 I.U.; and after 110 days 9,190 I.U. per pound.

P43. Nutritive Value of Barn-Cured Hay. K. L. TURK AND C. L. NORTON, Department of Animal Husbandry, Cornell University, Ithaca, New York.

Feeding trials have been conducted to compare the feeding value of barn-cured hay with hay cured in the field baled with a windrow baler, and with field-cured hay stored in a long condition. Results of two years' experiments are reported.

In an 18-week reversal study, 15 Holstein cows were fed each of the three hays for a period of six weeks. There was no transition between experimental periods. The hay, a mixture of grasses and legumes, was the only roughage and was fed in amounts that allowed some weighbacks. Grain was fed at an arbitrary declining rate.

A summary of the milk production showed only slight differences between the three hays. When fed the experimental hays, the cows produced the following daily amounts of 4 per cent F.C.M.: barn-cured, 30.0 lbs.; field-cured baled, 29.3 lbs.; and field-cured long, 28.9 lbs. However, the palatability of the hays as judged by the pounds consumed daily assumed a different order: field-cured long, 33.5 lbs.; barn-dried, 32.7 lbs.; and field-cured baled, 30.8 lbs. These differences were not of sufficient magnitude to assume any practical importance. The barn-cured hay, however, had a noticeably greener color, a slightly higher carotene content, and a consistently higher official grade.

A second year's trial using first cutting and second cutting alfalfa hay gave similar results. There was no consistent advantage for any one treatment in the amount of hay consumed per head per day, nor in the amount of 4 per cent F.C.M. produced daily. Carotene values showed an advantage for the barn-cured hay over the field-cured hays. Federal grades were uniformly higher for the barn-cured hay.

P44. A Still Unidentified Nutrient in Roughages and in Milk. A. M. HARTMAN AND C. A. CARY, Division of Nutrition and Physiology, Bureau of Dairy Industry, Agricultural Research Administration, United States Department of Agriculture.

A still unidentified nutrient, X, occurs in milk, skim milk, commercial skim milk powders, cheeses, and certain other foods and feeds. Casein preparations may be excellent sources of X or be entirely deficient in it, depending upon how they are made. When rats depleted of X are placed on diets deficient in X but adequate in respect to all known nutrients, their rates of growth, development and fattening are decidedly retarded. With diets of this sort containing 25 per cent or 45 per cent of protein such rats grow at rates that are, respectively, only 54 per cent and 25 per cent of that of their sex-litter mates receiving X as a supplement to such a diet; and rats receiving 65 per cent of protein generally fail to survive on such a

diet deficient in X, whereas their sex-litter mates receiving X survive and make good growth.

X is not present in whole wheat flour, white flour, enriched white flour, wheat bran, corn meal, soybean oil meal, linseed oil meal, heat-coagulated egg-white or yeast. Besides occurring in milk and the milk products referred to above, X occurs in bluegrass, alfalfa and alfalfa hays, timothy hays, lettuce, egg yolk, beef muscle and pork muscle. The X potency of milks produced by cows on different barn rations and on pasture have been compared.

P45. Fan-Ventilated Long Hay; A Chemical Study. A. E. PERKINS, LOUISE SKINNER, AND R. G. WASHBURN, Ohio Agricultural Experiment Station.

During both the 1944–45 and 1945–46 seasons, second cutting mixed alfalfa was fan-ventilated in a small mow at the dairy barn of the Ohio Agricultural Experiment Station in cooperation with the Department of Agricultural Engineering. A home-built fan which proved relatively inefficient was used the first season. This was replaced by a more efficient fan and an improved form of duct in the later test.

In addition to dry-matter determinations to ascertain the progress of drying, chemical analyses including determinations of total sugars and carotene as well as the usual feed analysis were made at each stage of the operation from standing crop to hay as fed.

The hay in both seasons was fed to dairy heifers in a palatability comparison, with field-cured hay from the same crop 1944–45, and with the best commercial baled hay locally obtainable 1945–46.

Three larger successive batches of hay were also fan-dried in another barn over a single installation, by baling out the first two lots. No feeding comparison was made with this hay though all the lots were judged to be of high quality. The workmen and feeders, not always too friendly to innovations, were favorably impressed with the hay. Chemical studies were likewise made covering all stages of the operation.

In the first season's operation, the hay was stored at an average dry matter content of 52 per cent and the fan, in addition to being somewhat inefficient, was operated intermittently after the first few days. The resulting hay had a lower carotene and sugar content and was less palatable to the heifers than the field-cured hay from the same crop, made under highly favorable conditions, with which it was compared; but it was eaten when fed alone and was probably superior to most weather-damaged hay.

In the second season, both installations operated efficiently. Most of the lots were somewhat higher in dry matter when stored and the fans were run continuously until the hay a few inches beneath the surface had attained a dry matter content of about 80 per cent. All the hay dried under these

conditions had contents of carotene and sugar comparing favorably with the field-cured portions of the same crop. One lot in particular which was fed in a palatability comparison was far superior to any hay with which it was compared. Its sugar content was well preserved and the carotene content, particularly toward the bottom of the mow, was remarkedly high—35–45 parts per million. Only the chemical results are presented in detail.

P46. The Comparative Feeding Value of Wilted Alfalfa Silage and Alfalfa Hay for Dairy Cows. J. B. SHEPHERD, R. E. HODGSON, AND W. J. SWEETMAN, Division of Nutrition and Physiology, Bureau of Dairy Industry, Agricultural Research Administration, U. S. Department of Agriculture.

Wilted alfalfa silage, barn-cured alfalfa hay and field-cured alfalfa hay harvested from the same fields at the same time during favorable weather were each fed to milking cows in a double reversal, double latin square design experiment using six groups of 3 cows each over three periods of 40 days each (10 preliminary and 30 experimental).

The wilted alfalfa silage as fed contained 40 per cent dry matter having 22.6 per cent protein and 82 micrograms carotene per gram. The barn-cured alfalfa hay was graded U. S. No. 2 leafy alfalfa clover mixed and as fed the dry matter contained 20.37 per cent protein and 22 micrograms carotene per gram. The field-cured hay was graded U. S. No. 2 alfalfa clover mixed and as fed the dry matter contained 19.26 per cent protein and 12 micrograms carotene per gram. On a dry matter basis, 11.2 per cent more of wilted alfalfa silage and 6.7 per cent more of barn-cured alfalfa hay were available for feeding than of field-cured alfalfa hay. The top third of the barn-cured hay was somewhat dusty in the central part of the mow.

The cows were fed all of each of these alfalfa roughages they would eat along with one and one half pounds of corn silage per 100 pounds liveweight daily and a 15 per cent protein grain mixture apportioned at the rate of one pound for each 3.5 pounds of 4 per cent fat-corrected milk produced.

As judged by alfalfa dry matter consumed in the preliminary periods, the wilted alfalfa silage was slightly more palatable than the barn-cured and field-cured hays which were about equally palatable. When fed wilted alfalfa silage the cows produced 3.1 per cent more 4 per cent fat-corrected milk, declined in milk production at a slower rate and made better liveweight gains, with slightly less grain, total dry matter and total feed nutrients than when fed barn-cured hay or field-cured hay. These results are in agreement with a similar experiment conducted last year in which cows produced 7.0 per cent more milk on wilted alfalfa silage than on field-cured alfalfa hay cut from the same field 3 days later and cured without rain, with 50-day declines in milk production of 6.7 and 20.9 per cent, respectively, when fed these feeds.

In the current experiment the cows produced about the same amount of milk but declined in milk production at a little slower rate and made better liveweight gains when fed field-cured alfalfa hay than when fed barn-cured alfalfa hay, consuming about the same amount of total dry matter and total feed nutrients.

On wilted alfalfa silage, barn-cured alfalfa hay and field-cured alfalfa hay, respectively, daily milk production (4% F.C.M.) averaged 32.8, 31.9, and 31.8 pounds; 30-day decline in production 4.3, 10.0, and 5.9 per cent; daily liveweight gains 0.47, 0.03, and 0.40 pounds; daily alfalfa dry-matter consumption 17.2, 17.2, and 17.5 pounds; daily corn silage dry matter consumption 4.9, 4.8, and 4.9 pounds; daily grain dry matter consumption 8.4, 8.8, and 8.6 pounds; and total dry matter 30.5, 30.8, and 31.0 pounds per cow daily. On all three rations the cows received considerably more protein and slightly more total nutrients than called for by the Morrison feeding standard.

The consumption of alfalfa dry matter and total dry matter per 100 pounds of 4 per cent fat-corrected milk averaged 52.4 and 92.9 pounds respectively on the wilted alfalfa silage ration; 53.9 and 96.5 pounds respectively on the barn-cured alfalfa hay ration and 55.0 and 97.4 pounds respectively on the field-cured alfalfa hay ration. Fed as above, milk production per acre of alfalfa forage (plus corn silage and grain) amounted to 16 per cent more on the wilted alfalfa silage ration and 9 per cent more on the barn-cured alfalfa hay ration than on the field-cured alfalfa hay ration.

BREEDING

P48. Crossing Zebu with Northern Breeds of Cattle in Jamaica. JOHN W. HOWE, Iowa State College, Ames, Iowa.

Purebred dairy cattle of the breeds raised in the United States, when raised under tropical conditions show lack of growth and development, combined with a lowered milk production. High mortality is caused from tropical diseases, to which such animals are susceptible. To develop an animal resistant to such conditions, the Jamaica Department of Agriculture in 1921 started crossing the Sahiwal breed (imported from India) with the Jersey, Guernsey and Holstein breeds. Jersey crosses, having from $\frac{1}{4}$ to $\frac{1}{8}$ Zebu blood gave the most satisfactory results in both production and resistance to environment.

P49. Some Experiences with Central Artificial Breeding Organizations. H. A. HERMAN, W. K. DINWIDDIE, AND M. J. REGAN, University of Missouri.

Five years experience with a *central* or *federated* dairy cattle artificial breeding organization in Missouri has indicated that this type of project is

well adapted to large-scale operations and has many advantages from the standpoint of economy, flexibility, and efficiency over smaller local breeding associations. At the present time 3 such organizations, involving 55 local units, and servicing some 50,000 cows annually are in operation. A fourth organization is in the process of formation. One of these organizations is a cooperative, one a semi-cooperative, and the third is privately fostered. This last-named organization, The Mid-West Breeding Farms, Trenton, Missouri, is owned and sponsored by the Central Farm Products Company, Trenton, Missouri, in cooperation with the Missouri College of Agriculture. This organization is in its fifth year and was set up to provide approved sire service in an area where the trend is definitely toward dairy and livestock farming. All inseminators are well-trained laymen who work on a salary and a bonus system. A veterinarian employed by the company to aid in all herd health and technical problems is available. All sires, 12 to 15 in number, including several proved sires, are approved by the Missouri College of Agriculture. A summary of field results for 10 local units of this organization from February 1943 to June 1945 reveals that during this period 6052 cows were serviced. A total of 8968 services were required with an average conception rate of 1.8 services. About 86 per cent of the cows settled the first 3 services. Cows serviced the first time in December, January, and August required the largest number of services. The spring months were the most favorable. For 16 sires studied the conception rate ranges from 1.6 to 2.4 services per calf. In local units the average conception rate varies from 1.5 to 1.9 services. Semen collections were made at an average of 5 times per month. Some sires were occasionally used 7 to 8 times per month. The initial motility of the semen averaged 3.7 and was diluted at the ratio of 1:8. The average storage time was 34 hours. The number of cows settled per year per sire ranged from 150 to 414 with an average of approximately 300 for the average sire in full service. If all of the semen had been utilized, several times this number could have been settled per sire. With the expansion from 10 to 19 units a more efficient use of semen will naturally result. This organization was not founded with the idea of making profits. Financially the project has been able to pay rent on the barns and land where the bulls are housed, feed and operating expenses, salaries, bull replacement costs, etc., but has otherwise returned no startling dividends. The service fee is $6.00 per cow. Patrons of the Central Farm Products Company receive a refund of $2.00 as a means of encouraging greater participation in the use of better sires.

P50. The Use of Pregnancy Diagnosis with Artificial Breeding. L. E. Casida, G. R. Barrett, and C. A. Lloyd, University of Wisconsin.

Pregnancy diagnoses were made on the cows inseminated in the Wisconsin Experimental Breeding Project during the months of February to May

and September to December, 1945, inclusive. The method of Wisnicky and Casida (unpublished), which depends on palpation of the amniotic vesicle, was used beginning at 34 days after breeding and the majority of the diagnoses were made before 50 days after breeding. For 3,099 inseminations, a comparison of the fertility as determined by palpation with the fertility as estimated from the herd books, based on "non-return" information, showed a discrepancy of 15.3 per cent at 30 to 60 days, 6.1 per cent at 60 to 90 days, and 3.0 per cent at 90 to 120 days. These data do not include 78 additional inseminations on which no information was obtainable but which would have been considered 100 per cent pregnant on the basis of "non-return" information. An analysis will be presented of the homogeneity of these discrepancies in relation to month and season of the year and number of previous services on the individual cows. Evidence was obtained indicating that at least 4 per cent of the diagnosed pregnancies were lost before the end of 4 months.

P51. The Effect of Certain Coal-Tar Dyes Used for Semen Identification on the Livability and Fertility of Bull Spermatozoa. JOHN O. ALMQUIST, Pennsylvania Agricultural Experiment Station, State College, Pa.

In the routine use of artificial breeding of dairy cattle it is impossible to distinguish the semen of one breed from that of another by any characteristic exhibited by the semen itself. Studies were made to determine whether certain coal-tar dyes could be used to color diluted semen in order to reduce errors in its handling, particularly in those instances where semen of one breed might inadvertently be used to inseminate cows of a different breed.

Preliminary studies indicated that coal-tar dyes obtained commercially in liquid form offered a simple means of coloring semen under field conditions. The aqueous solutions of coal-tar dyes used in these studies were certified by the U. S. Food and Drug Administration and required no further preparation before use. These certified liquid dyes are standardized as to strength, uniform as to color intensity and can be stored for long periods of time. Since semen diluted with egg yolk-citrate is yellow in color, it was necessary to resort to the use of shades or tints. The following certified solutions of coal-tar dyes as prepared by the Warner-Jenkinson Manufacturing Company of St. Louis, Missouri, were found to give adequate color differentiation when added to diluted semen: (1) strawberry shade red color (pure dye content not less than 5.2%), (2) emerald shade green color (pure dye content not less than 2.7%), (3) purple shade grape color (pure dye content not less than 4.1%) and (4) brown color (pure dye content not less than 3.7%). Chemically these colors are blends of various azo, pyrazolone, and triphenylmethane dyes.

To determine the influence of these dyes on the livability of spermatozoa, semen samples diluted at the rate of one part of semen to 10 parts of egg yolk-citrate diluter were colored using one drop of dye solution for each 10 ml. of diluent. A total of 15 semen samples were stored at 40° F. and the percentages of motile spermatozoa were determined every 2 days for a period of 10 days. Analysis of variance involving 375 motility estimations showed a significant difference ($P = < 0.05$) between treatments. Highly significant differences ($P = < 0.01$) between ejaculates and between storage intervals, as well as a highly significant storage interval × ejaculate interaction were found. The red and green color preparations significantly reduced spermatozoon livability while the means for semen colored brown and purple were not significantly different from the mean of the untreated control.

After the foregoing experiments upon spermatozoon livability were completed, a study was conducted to determine the effects of these color preparations upon the fertility of semen used under routine artificial breeding conditions. A field trial was conducted utilizing 10 semen samples from each of 5 bulls in a Latin square experimental design involving the 4 previously described color reagents with proper controls. In this experiment a lower concentration of dye was employed; thus one drop of the red, green and brown shades was added for each 25 ml. of egg yolk-citrate diluter (or 0.2 ml. of dye solution per 100 ml. of diluter) while one drop of the purple shade was added for each 15 ml. of diluter. These concentrations provided adequate color distinctions. A total of 2,995 inseminations, of which 2,376 were first services and 619 were second services, were involved in this experiment. When data based on the percentages of first and second service cows which did not return for service within 60 days were used, no statistically significant differences were found in the fertility of the colored and uncolored semen samples.

P52. The Effect of Feeding Potassium Iodide and Skim Milk Powder on Spermatogenesis. C. E. Knoop, Ohio Agricultural Experiment Station, Wooster, Ohio.

The effects on spermatogenesis with certain problem bulls in artificial breeding work were noted when a normal ration of legume or mixed hay and a regular concentrate mixture was supplemented by one of the following: A high protein feed containing kelp and fishmeal, iron and copper salts, iodinated-casein, shark liver oil, potassium iodide, skim milk powder, or a combination of potassium iodide and skim milk powder. Marked improvement in semen quality was observed in 7 of the 11 problem sires who daily received 50 mg. potassium iodide plus 0.8 pound skim milk powder for a period of 2 to 6 months. Improved spermatogenesis was indicated by one or all of the following factors: libido, quantity of semen, output of sperm cells, percentage of living sperm cells, and the motility-activity rating of the cells.

P53. Seasonal Effect on Spermatogenic Activity in the Bull and Reproduction in Cattle. ERNEST MERCIER, Department of Animal Husbandry, Cornell University, Ithaca, N. Y.

A yearly study of the semen characteristics of 10 bulls (5 Holstein and 5 Guernsey) used for artificial insemination in New York State revealed a highly significant breed difference only in respect to fertility.

Highly significant individual differences occurred for frequency of collection, volume, concentration, total sperm per ejaculate, methylene blue reduction time (M.B.R.T.), tailless heads, abnormals and fertility. The differences among bulls in the percentage of motile sperm was significant at the 5 per cent level of probability.

Highly significant monthly differences occurred for all the above-mentioned characteristics, except volume which varied at the 5 per cent level of probability and total number of spermatozoa which did not vary significantly.

A comparison between consecutive first and second ejaculates collected at a brief interval of time revealed a highly significant difference in respect to volume, percentage of motile sperm, concentration, total spermatozoa and tailless heads. The difference between ejaculates in the proportion of abnormal spermatozoa did not vary significantly.

A highly significant positive correlation occurred between the concentration and the fertility of 318 ungrouped ejaculations of these 10 bulls. In the same ejaculates, methylene blue reduction time and morphologically abnormal spermatozoa were negatively correlated with fertility at the 5 per cent level of probability.

The determination of the relationship between the characteristics of semen collected from 1942 through 1944 and the climatic factors for the corresponding period (temperature, barometric pressure, relative humidity, and length of day) showed that temperature and length of daylight are both negatively correlated with spermatogenic activity in the bull and reproduction in cattle under New York conditions. However, outside temperature and length of day are positively correlated with fertility of cattle under natural breeding in Eastern Canada.

P54. Time of Insemination and Conception Rate in Artificial Breeding. G. R. BARRETT AND L. E. CASIDA, University of Wisconsin.

Owners of cows bred in the Wisconsin Experimental Breeding Project are asked to report the hour at which cows are first noticed in heat. This time and the time of breeding are recorded by the inseminator. Such information is available on 3,841 inseminations made during the periods from January 24 to May 31, 1945, and from August 13, 1945, to January 31, 1946. These have been grouped, according to the length of interval from notice of heat to time of insemination, into the following classes: less than 3 hours;

3 but < 6; 6 but < 9; 9 but < 16; 16 but < 20; 20 but < 25; 25 or more hours. The method of determining the fertility of inseminations is described by Casida, Barrett, and Lloyd in another paper at this meeting. The percentages of conception for the above groups are, respectively, 46.3, 55.8, 54.0, 53.5, 54.4, 50.5, 43.6 per cent, while the average for the entire group is 52.4.

P55. Artificial Insemination as a Means of Genetic Improvement. J. L. LUSH, Iowa State College.

Artificial breeding as compared with natural breeding may change the genetic composition of the next generation in either or both of two ways: (1) by decreasing the fraction of all males born which are to be used as sires, and (2) by improving the accuracy with which the breeding values of the potential sires are estimated at the time of deciding whether to use them or not. Artificial breeding, as compared with natural breeding, can make large changes in (1) but only small changes in (2). How much the rate of genetic improvement of the dairy population will be increased by these changes is appraised on the basis of what is known about: (a) the amount of genetic variability in the population, (b) the correlation between estimated and actual breeding values of sires, and (c) the amount by which the estimated breeding values of the selected sires exceeds the average breeding value of all males born.

P56. Deleterious Recessive Genes in Dairy Bulls Selected at Random. S. W. MEAD, P. W. GREGORY, AND W. M. REGAN, University of California, Davis.

The background of the University of California breeding experiment with dairy cattle is presented, with a description of the original stock. Six unrelated sires, five Jersey and one Holstein, were selected at random so far as recessive genes were concerned and were tested for recessives by sire-daughter matings and other mating tests. Although some of the recessive genes carried by the sires may perhaps have escaped detection, there is no doubt concerning the eight that were positively identified.

Two lethal genes were found—one conditioning imperfect epithelium, the other an achondroplasia-like anomaly. The nonlethal genes were those conditioning proportionate dwarfism, flexed pasterns, strabismus, and congenital cataract. Two different forms of female sterility that prevented heifers from conceiving or producing offspring were also encountered. In the sterility found, only in animals of the Jersey herd, did all the affected heifers manifest normal heat periods. The sterility found only in the Holstein breed was associated with an abnormal estrous cycle, usually complete absence of heat. Both forms of sterility are sex-limited. There was no evi-

dence that the fertility of heterozygous cows is impaired. One Jersey bull that was fully fertile was assumed to be homozygous for the Jersey type of female sterility. None of the sires proved were homozygous for the Holstein type of female sterility; but it is assumed that homozygous bulls are fertile. The expected proportions of sterility in heifers based upon the gene frequencies found are compared with the actual figures recorded in the literature.

The matings provided some data concerning the linkage relations of certain combinations of the mutant genes. The matings involving the combination of achondroplasia, strabismus, and flexed pasterns indicated that these genes are independent. Other matings indicated that cataract and the female sterility found in Jerseys are independent.

The feasibility of an organized program for amassing all kinds of genetic data on domestic animals is discussed.

THE FORTY–FIRST ANNUAL MEETING OF THE AMERICAN DAIRY SCIENCE ASSOCIATION

R. B. STOLTZ, *Secretary-Treasurer*

The American Dairy Science Association assembled in the Memorial Union at Iowa State College, Ames, Iowa, on Tuesday, June 18, 1946, at 9:30 A.M.

C. A. Iverson, Head of the Department of Dairy Industry, Iowa State College, introduced President Charles E. Friley, of Iowa State College, who gave the address of welcome.

Association President John A. Nelson was then presented and gave the following address:

THE PRESIDENT'S MESSAGE

It gives me great pleasure to address you at this forty-first annual meeting of the Association. The occasion affords additional gratification because it marks the twenty-fourth anniversary of my graduation from Iowa State College.

We are living in a changing world and the dairy industry is making its share of the changes. The direction these changes will take and how much they will benefit the dairy industry will depend very largely on the activity of each and every member of this Association. The American Dairy Science Association has a real responsibility to the industry it serves. More and more in the future the dairy industry must depend on the scientist to enhance the efficiency of dairy production, increase the efficiency of the processing of dairy products, discover new methods, new processes and new products that will tend to increase the consumption of dairy products. The scientist must aid in improving the sanitary standards and must aid in enhancing the quality of dairy products which have the kind of flavor that will appeal to more and more people. The future of the dairy industry will depend very largely on the amount and kind of research done and the application of this research in expanding the scope of the dairy industry field.

The biochemist, the bacteriologist, the geneticist, the nutritionist, the physiologist and research workers in other allied fields have made many valuable contributions to the dairy industry. In order to put the dairy industry in the strategic position which it rightly deserves, there is great need for continued emphasis on both practical and fundamental research in these fields. The future of the dairy industry will depend primarily on the kind and the amount of research done in the next few decades. The value of research can be more fully appreciated when it is considered that the industries making the most rapid progress are those most successful in solving research problems. Many commercial dairy concerns have established re-

search work as a potential business development agency and by so doing have become leaders in the field.

It would be folly to list the research needed in the order of importance. However, there are some problems that have been aggravated by the war that need immediate attention. There are good indications that there will be a critical shortage of high-protein feeds for dairy cows in the near future. This means that the agricultural experiment stations must find substitutes for the more common dairy feeds if milk production is to be held up to a point where there will be sufficient dairy products necessary in the diet.

In view of the post-war shortage in dairy feeds, an agricultural experiment station in the Pacific Northwest conducted experiments with ground wild yellow mustard seed and ground fanweed seed as concentrate feeds for milking cows. It was found that these weed seeds compared favorably with soybean oil meal as a protein supplement to the grain ration. Contrary to the general belief, neither of these weed seeds had any detrimental effect on the flavor of the milk produced when properly fed after milking. Feeding trials have been conducted at the same station on substituting cull potatoes for part of the grain ration for milking cows. The results indicate that five pounds of potatoes can be fed in lieu of a pound of the grain concentrate. Organoleptic flavor evaluations of the milk produced indicated that potatoes do not impart an objectionable flavor to the milk produced. The findings of this station will be of great value to the dairy producers of the Pacific Northwest where these weed seeds are found in sufficient quantities as screenings from other grains and where large acreages of potatoes are grown. These experiments were mentioned only to indicate that this type of practical research can be done in other areas primarily to alleviate an approaching dairy feed shortage which no doubt will occur in all sections of the United States.

The discovery that the microorganisms in the rumen of the dairy cow can make protein from urea nitrogen and that urea can be fed to replace some of the high-protein feeds may have a real significance in the near future. Further investigations of this chemical product may prove it to be of a great and lasting benefit to milk producers. Further studies on the improved practices in harvesting roughages, especially alfalfa hay, would do much to help dairymen to produce more protein and other nutrients for the dairy ration. The foregoing are only a few of the practical research problems that are urgent and should be solved in the interest of the dairy farmer.

The time has come when more attention must be paid to milk production. The progress and growth of the dairy industry depends on efficient milk production. Efficient milk production depends upon the application of science to production problems. Researches on artificial insemination, the hormone thyroxine which has to do with the stimulation and intensity of milk and fat secretion, thyroprotein, calfhood vaccination, and fast or

planned milking will all have a beneficial influence on increasing the efficiency of milk production if applied under the proper direction.

A discussion of the production phase of the industry would not be complete unless recognition is given to the accomplishments of the veterinarian and the animal pathologist and the part they have played in the progress made by the dairy industry. These scientists have tuberculosis well under control and are moving ahead with plans for the control of brucellosis. The next big step forward in animal disease control is to reduce the occurrence of mastitis. Some of the dairy production scientists have reason to believe that mastitis is primarily a herd management problem. The majority of the evidence seems to be on the side of those who believe it is a management problem. There is need for more research on mastitis. When more is known of the direct and indirect causes of this common udder affliction, definite progress can be made to lessen the occurrence of this disease which is greatly reducing the production in the majority of the dairy herds.

During World War II, considerable interest was placed on the vitamin A potency of butter. The preliminary report on the cooperative survey on vitamin A in butter issued by the USDA reveals that vitamin A potency of butters made in the different sections of the United States varies greatly by sections and also by seasons. The higher vitamin A content of summer butter over that made in the winter season is due no doubt to the higher beta carotene content in the summer feed. If the scientist could find ways and means to conserve more of the beta carotene in the feeds during harvest and storage, it would aid materially in increasing the vitamin A content of butter made in the winter season.

Dairy Herd Improvement Associations have been considered the most valuable project in dairy extension work. They have been of inestimable value in building up the production of dairy herds. Valuable as they are we have not been able to get more than a small percentage of the dairy cows in the United States tested under this plan. Dairy herd testing is the foundation of all good dairy practices. Dairy extension specialists should be encouraged to do all that can be done to get more cows under a testing plan. No milk producer can manage his herd intelligently unless he knows the production and the economy of production of every cow in the herd. This may sound too idealistic, but it would be a real step toward profitable dairying if the average fat production of the dairy cows in the United States would be twice what it is at the present time. That is a real goal for the dairy production extension specialist.

Teaching methods in the different dairy industry fields have undergone changes in the past two decades. The quality of teaching has been improved. Dairy course graduates have become leaders in their fields. Practical short courses have been given for the men working with the herds and in the plants. Short courses of the conventional type, from a few days to

a few weeks duration, have done much to help put dairy science into practice. There is need for the enlargement of the teaching program. Many workers in the practical dairy field are not being reached. For example, since fast or planned milking has been introduced, practical instruction on how to carry out this milking procedure has not been given to many milkers. If fast or planned milking were practiced universally, the production of milk would be greatly increased.

It is gratifying to have the members of this association take an active part in the improvement of the quality of dairy products. The direction the dairy industry will take in the future will depend on what is done about quality. In the future, when dairy products become plentiful again, the market will change from a seller to a buyer market. Then the consumer will tell the industry the quality of product he demands and the plants with the high quality products will get increased sales. The plant that has quality has the confidence of the consumer. The plant that has the quality will have the kind of flavor in the product that the consumer desires.

The dairy scientist can do much for the industry in helping dairy plants with their sanitary problems. Plants are not only becoming more interested in sanitation, but they are actually showing aggression toward a cleaner, more sanitary and more attractive plant. Dairy manufacturers are beginning to realize that a step forward in sanitation is also a step forward in consumer confidence and confidence is needed to make any business successful.

Just previous to and during World War II, much was said about using more of the milk solids "below the cream line." The superior nutritive value of these milk solids has been fully recognized by nutritionists for some time. When non-fat milk solids are consumed in cheese, ice cream or other dairy products which contain them, they have consumer appeal. The main difficulty in getting more of these solids consumed as human food is to get them into a more appetizing form than that of non-fat dried milk solids to be used as such. From the standpoint of improved human nutrition and also from the standpoint of increased financial return to dairy farmers, the research worker can make a real contribution by continuing to develop new food and industrial uses for non-fat dry milk solids.

It is reported that about two-thirds of the annual production of slightly less than 300,000,000 pounds of non-fat dry milk solids produced before the war was used by the baking industry. It is known that non-fat milk solids have a number of advantages in baking, not only in the baking but in the increased food value and other desirable characteristics of the baked products. If the consumer knew how much the nutritive value of white bread is increased by the addition of 6 per cent non-fat dry milk solids, he would demand bread that contained these added solids. Considering the possibility of improving human nutrition and at the same time increasing the sale of

milk solids, would it not be a good project for the dairy industry to cooperate with the baking industry to bring about a universal dry milk enrichment program for baked goods? Research that has been done and is being done seems to indicate that benefits other than increased nutritional value are also in the offing. This example is cited to point out what research in the right direction can do for the dairy industry, the baking industry, and for the consumers of bread products which includes a very high percentage of the population of the world.

There is a trend toward consumers' paying more attention to the flavor of foods. Many food manufacturers are making flavor appeals through magazine and motion picture advertising and radio broadcasts. The dairy industry has not fully realized the necessity of making flavor appeals to increase the sale of dairy products. There are examples in the dairy industry that go to show that flavor does have sales appeal. Milk dealers witness the sale of homogenized milk increasing at the expense of the sales of the same product that is not homogenized. Consumers forego the once popular cream line and the privilege of pouring off the top milk to be used as cream in order to get homogenized milk which has a more pleasing flavor than the same product would have if it were not homogenized. Observations like these bring out the desirability of doing more research on the improvement of flavor in dairy products. If nothing more is done than to teach milk producers the proper methods of feeding milking cows, there would be a general improvement in the flavor of the milk supply. The importance of feeding milking cows strong flavored feeds at the proper time so that their milk will be of good flavor has been demonstrated by some of the experiment stations. Experiments were conducted in which milking cows were fed eight per cent of ground fanweed seed in the grain ration immediately after milking without any detrimental effects on the flavor of the milk produced by the cows.

The American Dairy Science Association has a great future if we continue to work cooperatively and diligently. We have made progress during the past year. Secretary Stoltz will have a stimulating report to make to you at the business meeting on the progress of the Association the past year. We cannot endure long on the stimulation given us by a report. We must build to greater heights and to greater usefulness to the dairy industry. We should take interest in all activities large or small that will benefit the industry. We should act as advisors to dairy groups in our community. Our advice will do much to help improve the industry and put scientific methods and devices into practice in the community.

We have made a steady gain in membership but we must not become complacent on continuing to build up the membership of the Association. There is a cooperative creamery in the Pacific Northwest that has a slogan "Every Member a Field Man." That would be a good slogan for us if it were changed to "Every Member Get a New Member." Every thriving

business must get new business to be successful. ADSA must continue to build up membership in order to be of greatest benefit to the industry it serves.

The year of tenure as President of ADSA has been an enjoyable one. Thanks to every member for your support and forebearance of all the mistakes or other sins of omission for no doubt there were many.

Mr. E. S. Estel, Editor of the Creamery Journal, Manager of the Dairy Cattle Congress, and Secretary of Iowa State Dairy Association, was then introduced and gave a very interesting address on the Dairy Industry. There were 296 members present.

GENERAL MEETING OF THE AMERICAN DAIRY SCIENCE ASSOCIATION

Ames, Iowa, June 20, 1946

President Nelson called the meeting to order at 3:00 P.M. in the agricultural assembly room of Agricultural Hall. There were 163 present.

EDITOR'S REPORT

During the past year, twelve monthly issues of the JOURNAL OF DAIRY SCIENCE were published. We regret that these issues did not always appear on schedule. However, their lateness in reaching your hands resulted from conditions beyond the editor's control.

Volume 28 of the JOURNAL OF DAIRY SCIENCE consisted of 996 pages of original articles, announcements, proceedings of the Annual Business Meeting and indices. This volume also contained 196 pages of Abstracts and abstract indices. The total number of Journal pages devoted to material other than advertising was 1,192.

Table 1 summarizes the Journal contents for volume 28; this table also includes similar summaries for volumes 26 and 27 for comparison.

TABLE 1

	Volume 26		Volume 27		Volume 28	
	No.	Pages	No.	Pages	No.	Pages
Manufacturing						
Original papers	59	542	40	356	51	484
Review papers	1	86	2	98	.....	.....
Production						
Original papers	38	362	50	410	47	418
Review papers	.....	.....	.....	.....	.....	.....
Miscellaneous	.....	176	.....	208	.....	94
Total	98	1166	92	1072	98	996
Abstracts	.....	264	.....	208	.....	196
Total pages printed	.....	1430	.....	1280	.....	1192

Ninety-eight original papers were published; 51 of these dealt with research in the field of dairy manufacturing and 47 dealt with production subjects.

Again the editor gratefully acknowledges the generous assistance of a host of loyal workers whose help makes possible the publication of the JOURNAL OF DAIRY SCIENCE.

Upon motion duly seconded, the Secretary was requested to spread upon the minutes words of appreciation regarding the splendid work of our Editor and to adopt his report. The motion was carried unanimously.

SECRETARY-TREASURER'S REPORT

Membership and Circulation. The report of membership and the total circulation of the Journal for the past fiscal year, as well as for the first five months of 1946, is very encouraging. At the close of 1945, we had a total paid circulation of 2399 which is more than 100 higher than the total for 1944. Last year an error was made in the report of the total circulation because the new members were added into the total. This total should have read 2266 instead of 2377. As of June 1, 1946, our membership has exceeded any previous figure. We had 1534 members which is more than 100 more than we had at the end of last year and excels our previous high year of 1939. The following table gives you the total circulation as of December 31 for the past nine years and as of June 1 this year.

Dec. 31	Members	New members	Subscribers		Associate subscribers	Student affiliates	Total
			Domestic	Foreign			
1937	928	.....	360	385	110	30	1813
1938	1101	332	352	395	125	81	2054
1939	1465	419	321	385	73	156	2400
1940	1339	105	331	360	62	283	2375
1941	1321	103	353	316	66	391	2447
1942	1276	100	371	212	49	235	2143
1943	1324	134	463	208	85	108	2188
1944	1388	111	519	233	81	45	2266
1945	1407	105	586	291	83	32	2399
June 1, '46	1534	215	579	310	85	162	2670

The following data is a summary of our loss and gain in members for the year 1945:

Membership, December 31, 1944		1388
Gain: New members, 1945	97	
Former student affiliates	8	
Total gain	105	
Loss: Members resigned and delinquent for 1945:		
Delinquent	35	
Resigned	32	
Deceased	1	
Servicemen	18	
Total loss	86	

Net gain in membership 19
Membership, December 31, 1945 1407

You will be interested to know that 72 per cent of our members pay their dues previous to January 1.

Following is a listing of our circulation by States as of June 1, 1946:

	Members	New members	Subscribers	Associate Subscribers	Student affiliates	Total
Alabama	5	...	3	1	...	9
Arizona	6	2	1	...	...	7
Arkansas	3	1	5	1	...	9
California	68	2	48	6	2	124
Colorado	10	1	5	...	...	15
Connecticut	17	1	7	...	1	25
Delaware	2	...	2	...	1	5
District of Col.	35	3	14	1	1	51
Florida	14	1	9	...	...	23
Georgia	20	9	10	1	1	32
Idaho	8	...	6	...	...	14
Illinois	149	17	47	2	5	203
Indiana	44	3	19	1	...	64
Iowa	33	3	8	...	67	108
Kansas	11	...	5	1	...	17
Kentucky	8	...	6	2	...	16
Louisiana	13	1	5	...	...	18
Maine	1	...	2	1	1	5
Maryland	40	2	9	1	...	50
Massachusetts	38	2	23	8	...	69
Michigan	54	5	13	8	...	75
Minnesota	50	6	12	4	...	66
Mississippi	10	2	2	...	...	12
Missouri	43	6	17	2	1	63
Montana	11	...	3	...	2	16
Nebraska	12	5	7	...	1	20
Nevada	1	...	1	...	...	2
New Hampshire	10	1	2	...	...	12
New Jersey	33	1	22	3	...	58
New Mexico	3	...	2	...	...	5
New York	142	17	82	8	2	234
North Carolina	14	...	8	...	...	22
North Dakota	2	...	3	...	...	5
Oklahoma	13	2	5	2	...	20
Ohio	168	33	38	9	17	232
Oregon	21	2	10	...	...	31
Pennsylvania	112	36	25	8	10	155
Rhode Island	2	...	4	...	...	6
South Carolina	9	2	1	...	...	10
South Dakota	6	...	2	...	...	8
Tennessee	14	2	6	2	14	36
Texas	30	8	28	...	1	59
Utah	11	2	5	1	5	22
Vermont	20	4	...	...	...	20
Virginia	31	1	10	2	5	48
Washington	35	2	11	2	6	54
West Virginia	15	2	3	2	...	20
Wisconsin	88	8	21	2	16	127
Wyoming	4	2	2	...	1	7
Canada & Foreign	45	6	310	4	2	361
Total	1534	203	889	85	162	2670

In computing the total circulation in the above table, the new members as listed in the second column, are included in the first column also and consequently are not included in the total column. Ohio leads with 168 members. Ilinois is second with 149, New York third with 142, and Pennsylvania fourth with 112. Pennsylvania leads with thirty-six new members. Ohio is second with thirty-three, Illinois and New York tie for third with seventeen. New York leads with eighty-two subscribers. California is second with forty-eight and Illinois third with forty-seven. Iowa leads in number of student affiliates with sixty-seven. Professor Goss, who is responsible for sending in this large number, is to be congratulated. Iowa has consistently been first in the past years in the number of student affiliates. New York leads in total circulation with 234. Ohio is second with 232 and Illinois third with 203. Pennsylvania is fourth with 155.

Back Copies. During the past year, your Association reproduced 200 copies each of nine separate numbers at a cost of more than $1600. When these Journals are resold, our income is less than half of our cost, but this reprinting of back copies is a service that our Association is doing for the dairy industry. Our income from back copies during the past year amounted to approximately $1500.

Advertising. Our advertising income is on the increase. In 1938 we sold 93.75 pages, and in 1945 we sold 194.5 pages. The following table gives the number of pages of advertising sold for the past eight years:

1938	93.75 pages	1942	143.75 "
1939	124.00 "	1943	171.00 "
1940	126.50 "	1944	190.00 "
1941	140.75 "	1945	194.50 "

We are pleased to take the opportunity to again express our grateful thanks to the companies that use our pages for advertising. Any courtesies shown our advertisers will be greatly appreciated.

Financial. The income for 1945 amounting to $22,600.42, is the largest income during any year of our organization. Our expenditures which also excelled previous years, were $19,210.22, leaving an operating profit of $3,390.20 as of December 31, 1945. Our net worth was $30,008.17. We had an investment in government bonds of $26,045.00. A complete report of the Certified Public Accountant was sent to each Officer and Director on March 27, 1946.

I wish to take this opportunity to express my gratitude and thanks to the officers and members for the splendid cooperation that they have given me.

Respectfully submitted,

R. B. Stoltz, *Secretary-Treasurer*

Upon motion duly seconded, the report was approved.

AUDITING COMMITTEE REPORT

The President then requested the report of the Auditing Committee which was given by Mr. O. F. Garrett.

May 27, 1946

To the Directors and Members of the
American Dairy Science Association
Gentlemen:

The Auditing Committee of the American Dairy Science Association met with Mr. Walter C. Burnham, the certified public accountant who examined the financial statement of the Secretary-Treasurer of the American Dairy Science Association. The Committee met with Mr. Burnham in Columbus on May 27, 1946.

Mr. Burnham stated that he had made a careful audit of the accounts, checked the bank statement and reconciled the checking account. He also stated that he counted the bonds held by the Association.

After conferring with Mr. Burnham, the Committee is satisfied that the statement submitted by the Secretary-Treasurer is correct. We recommend that it be accepted by the Board of Directors and the members of the American Dairy Science Association.

Respectfully submitted, IVAN MCKELLIP, O. F. GARRETT, R. A. LARSON

Upon motion duly seconded, the report of the Auditing Committee was accepted and ordered filed.

JOURNAL MANAGEMENT COMMITTEE REPORT

Mr. G. M. Trout, Chairman of the Journal Management Committee, then submitted the following report:

June 17, 1946

To the Executive Board
American Dairy Science Association
Gentlemen:

The Journal Management Committee, A.D.S.A., in session June 17, 1946, submit to the Executive Board for their consideration in rendering greater service to the dairy industry through the JOURNAL OF DAIRY SCIENCE, the following:

1st—Maintain the high scientific standard of the articles covering original work at all times.

2nd—Release abstracts of original articles to the press at the time the page proof of the article is sent to the publisher, the press consisting of trade journals in the various fields.

3rd—Encourage a greater number of good review articles.

4th—Add to the abstract section coverage of patent literature in the field of dairy and allied sciences.

5th—Recast present abstract service looking toward:

a. More extensive coverage

b. Better abstracts

6th—Study the possibility of securing and publishing the British Dairy Abstracts.

7th—Furnish membership with more extensive service consisting of book reviews, reviews of new developments in dairy and allied fields, personalia, calendar of coming dairy events, review of outstanding features of such meetings, dairy developments in foreign fields, etc.

8th—Conserve space in the Journal by:

a. Reducing size of some figures in articles, and by setting small figures at side of page with type around figure.

b. Reduce size of type in printing abstracts and

c. Reduce size of margins.

Respectfully,

W. E. PETERSEN, G. E. HOLM,

G. M. TROUT, *Chairman*

Inasmuch as the Executive Board did not approve all of these recommendations this report laid over until after the Executive Board made its report. The Executive Board recommended the passage of the first six recommendations and requested that the 7th one be deleted and that No. 8 be studied by the Editor regarding the conserving of space in the Journal and the additional possibility of changing the size of type and making a double column.

Upon motion duly seconded, the recommendations as approved by the Executive Board were voted upon and the motion was lost. It was then moved and seconded that the Journal Management Committee report be adopted. By amendment from the floor, recommendation No. 7 was changed to read "Furnish membership with news of the activities of our members." This amendment was carried. The motion was then put and it was carried.

REPORT OF THE PRODUCTION SECTION

Secretary George H. Wise of the Production Section, presented the following report.

The Production Section held two joint symposia with the Extension Section. The first of these meetings consisted of two phases, one dealing with committee reports and discussions pertaining to breed relations activities and the other with special reports and recommendations of the Dairy Cattle Breeding Committee and of the Pasture and Roughage Committee, respectively. In the second symposium, a panel discussion was presented on the subject of mastitis, including definition, etiology, diagnosis, prophylaxis and therapy.

In order that all research reports might be presented, the Production

Section was divided, thus permitting concurrent sessions. A total of 55 papers were presented. All meetings were well attended.

Two business meetings were held, the first of which was in conjunction with the Extension Section. The following reports were presented, approved and accepted by the two Sections in joint session:

Report of the Pasture and Roughage Committee: This was a summary of the information on the subject of "Evaluation of Pasture in D.H.I.A. Records." The variability in methods of estimating the values of pastures in different states emphasized the need for further study to simplify and to standardize evaluation procedures in various regions and under different systems of management.

The Sections further approved the committee recommendation that the activity of the group be terminated, but that the work on the methods of computing T.D.N. values of pasture be continued by R. E. Hodgson.

The Report of the Dairy Cattle Breeding Committee set forth recommendations for the "Requirements for Recognition as an Artificial Breeding Organization."

The Report of the Dairy Cattle Health Committee reviewed the development and progress of this committee, directed attention to the mastitis symposium this year as a result of their activity and suggested that brucellosis be the subject of discussion in 1947.

The Report of the Committee on Committee Revision recommended "that all transactions between the Purebred Dairy Cattle Association or the Dairy Breed Registry Organizations and the American Dairy Science Association be handled through the Breeds Relations Committee."

It was further recommended "that the Breeds Relations Committee refer such matters as may come within the province of other committees to the proper committee for its consideration and recommended action."

In addition to the foregoing committee reports accepted by the combined sections, the following were approved and accepted by the Production Section in a separate business session:

The Report of the Breeds Relations Committee, joint with the Extension Section, recommended that uniform rules of official testing, as developed by a special committee on this subject, be adopted. The report further indicated that the chairman of the Breeds Relations Committee would continue to serve on the Uniform Score Card Committee of the Purebred Dairy Cattle Association. With reference to the testing report forms the committee arranged for printing and distribution and accepted the responsibility of soliciting suggestions for revision of the H.I.R. report blanks.

The Report of the Feeds Relations Committee, in view of duplication of scope of activities, recommended that the committee be disbanded and that its activities be transferred to those representatives of the American Dairy Science Association serving on the college Feed Advisory Committee to the Feed Industry Council.

The Committee on Resolutions of the Production Section consisted of H. P. Davis, R. E. Hodgson and A. A. Borland, Ch. Their report was accepted and approved.

The Nomination Committee of the Production Section recommend that the incumbents, Vice-Chairman, D. M. Seath, and Secretary, George H. Wise, succeed to Chairman and Vice-Chairman, respectively. Nominations for secretary were presented. L. A. Moore of Beltsville, Maryland, was elected.

Requests for suggestions for improvement of future programs provoked considerable discussion. The section voted the continuance of concurrent sessions within the sectional program whenever the number of subjects rendered it necessary. The lack of time for adequate discussion of the subject matter was the most serious objection to the present program arrangement. It was suggested that consideration be given to plans that may ameliorate this condition.

Respectfully submitted,

G. W. SALISBURY, *Chairman*
D. M. SEATH, *Vice-Chairman*
GEORGE H. WISE, *Secretary*

Upon motion duly seconded, the report was accepted.

REPORT OF THE EXTENSION SECTION

Secretary E. H. Loveland of the Extension Section reported the following minutes, and upon motion duly seconded, this report was accepted.

At the opening business session held Tuesday, June 18, with Extension Section Chairman Floyd Arnold presiding, the report of the 1944 meeting was summarized and the report of the chairman for 1945 was read by the Secretary, E. H. Loveland, and both were adopted. Chairman Arnold appointed for Resolutions Committee, Perry, Porter and Regan; Nominating Committee, Scheidenhelm, Gearhart and Nystrom; Revision of Committees—Crandall, Loveland and Johnston.

Kendrick reported for the Testing Committee. It was voted that the report be accepted, that the recommendation on supervision and curricula for training for D.H.I.A. supervisors be adopted and that there be further report later on equipment which was later presented and adopted.

At the joint meeting with Production Section Wednesday forenoon the report of the pasture committee by R. B. Becker was adopted and the committee discontinued.

The report of the Dairy Cattle Breeding Committee was made by C. L. Blackman and adopted.

A recommendation was adopted that transactions between the Purebred Dairy Cattle Association and the American Dairy Science Association be handled by the Breeds Relations Committee and material referred by them to the proper committees.

The final business session was held Thursday morning with Chairman Arnold presiding.

Floyd Johnston made a report of the action of a Holstein-Friesian Association Committee on use of D.H.I.A. records by that association. The Extension Section went on record as favoring the use of these records by the breed association but opposed recognition of D.H.I.A. individual records for breed association publicity.

The following reports were adopted as presented:

Exhibits Committee by A. R. Porter; Farm Management Committee by R. Connolly; Breeds Relations Committee by Floyd Johnston; Dairy Cattle Health Committee by James Linn; 4-H Club Committee by Joe Nageotte; Type Rating by A. C. Baltzer.

Quality Committee by Everett Wallenfeldt. In this last report it was voted that the committee be discontinued but that the Manufacturing Section be asked to include an extension representative on their committee.

A motion was adopted urging all Purebred Dairy Cattle Clubs to send herd test records to the Bureau of Dairy Industry to be included in the proving of bulls.

The Resolutions Committee report was adopted and has been reported to the American Dairy Science Association Committee.

The group adopted amended recommendation on committee revision that standing committees be Breeds Relations; Dairy Cattle Breeding; Dairy Records; Dairy Cattle Health; 4-H Club; Teaching Methods and Program and that special committees be appointed as needed.

The report of the Nominating Committee that Arthur Porter of Iowa be secretary for the ensuing year was unanimously adopted.

The recorded attendance was 119.

Respectfully submitted,

E. H. LOVELAND, *Secretary*

REPORT OF THE MANUFACTURING SECTION

Secretary N. S. Golding of the Manufacturing Section gave the following report and upon motion duly seconded it was accepted.

The programs for the Manufacturing Section were held during the afternoon of Tuesday, June 18, and Wednesday, June 19, and Thursday, June 20, with L. K. Crowe as general chairman. Thirty-four titles were accepted for the program, and only two of the papers (M3, and M20) were not given. In addition to the regular papers, a Quality Symposium was held on Milk, Ice Cream, Butter, Cheese and Manufactured Products, with H. F. Judkins as chairman.

The Business Meetings of the Manufacturing Section were held Wednesday afternoon and Thursday morning. The Standing Committee reports were presented and accepted from the following committees:

(a) Committee for Milk and Cream—K. G. Weckel, Chairman (three of his sub-committees submitted written reports)

(b) Committee on Products Judging—G. M. Trout, Chairman.

Motions were passed as follows:

1. That the Milk and Cream Committee consider the advisability of working to the end of standardization of the Babcock test procedure throughout the country for approval of the Association and that it work with the A.O.A.C. organization.
2. That the chairman appoint a committee to study the matter of permanent records and that this committee also study the organization of the section.
3. That both titles and abstracts be submitted together to the Program Committee for the Annual Meeting.

The two officers elected were Paul R. Elliker, Lafayette, Indiana, Vice-chairman, and J. M. Trimble, Lebanon, Ind., Secy. The vice-chairman of the past year, C. L. Hankinson, Minneapolis, automatically becomes chairman for the coming year.

Respectfully submitted,

N. S. GOLDING, *Secretary*

NATIONAL RESEARCH COUNCIL REPORT

Mr. C. Y. Cannon who represents our Association on the National Research Council, gave the following report, and upon motion duly seconded the report was accepted.

My appointment as delegate of the American Dairy Science Association to the National Research Council for the years 1945–48 was made by President Nelson last August. Since that time I have tried to become thoroughly acquainted with the work of the National Research Council and the relation the American Dairy Science Association has to it. As you know the Dairy Science Association is allied with the Division of Biology and Agriculture of the Research Council. This Division has 27 affiliated member societies which includes such widely varying organizations as the American Dairy Science Association and the American Society of Ichthyologists and Herpetologists.

Several committees operating under the sponsorship of the Division of Biology and Agriculture are of particular interest to men in the dairy fields. Their recent annual reports indicate their activities. Under the direction of the Agricultural Board an *ad hoc* committee on the production and distribution of milk has been set up to work jointly with the Foods and Nutrition Board to study (1) legislative requirements and restrictions that do not provide an adequate return; (2) regional competition and (3) monopolistic practices that occur in specific milk sheds.

Another committee is also being formed to compile information on the

composition of all feed stuffs. A grant of $18,000 from Swift and Company will finance this operation.

During the past year the Committee on Animal Nutrition has issued, among other reports, one entitled "Recommended Nutrient Allowances for Dairy Cattle" which is especially helpful to dairymen.

The American Dairy Science Association requested of the National Research Council, its Interassociation Council and Agricultural Board that a committee be formed to study the public health aspects of brucellosis. Since such a study involves the Division of Medical Sciences, it was finally decided that two committees be appointed, with proper liaison between them, one by the Division of Biology and Agriculture and the other by the Division of Medical Sciences. Although Dr. Frank J. Sladen, Physician and Chief of the Henry Ford Hospital in Detroit, has been appointed as chairman of the committee on the human side, no other appointments to either of the committees have yet been made.

Two other aspects of animal health have been investigated (1) by the subcommittee on mastitis, whose report was published in the March 1946 issue of the Journal of the American Veterinary Medical Association and (2) by the subcommittee on bloat, whose report appeared in the August 1945 issue of the Journal of Animal Science.

Your representative attended the annual meeting of the Division of Biology and Agriculture held in Washington, D. C., on Saturday, April 13, 1946. This meeting listened to the following reports:

Present Status of the National Science Foundation Bill by Dr. Barry Commoner.

Projected Institute of American Biologists by Dr. Detlev W. Bronk.

The Prevention of Deterioration of Equipment in the Tropics by Dr. Glenn A. Greathouse.

The Work of the Insect Control Committee by Dr. R. A. Ormsbee.

Problems of Scientific Personnel by Dr. M. H. Trytten.

In addition, Dr. D. W. Bronk, Chairman of the Committee on International Scientific Relations, reported the activities of his committee in establishing contact with scientists in foreign countries and providing them help where and when needed.

Two requests for action by member societies came out of this meeting. The first request was that backing be given to the A.A.A.S. committee, recently set up for the purpose of supporting Senate Bill 1850 which provides funds for an enlarged research program. This bill is a compromise between the Kilgore and Magnuson bills and has passed the Military Affairs Committee and is reported out to the Senate. Although it is now on the Senate Calendar, Senator Thomas (Utah), Chairman of the Military Affairs Committee, indicated that the bill would probably die there unless very strong backing were given him by scientists to get Senate action. The

American Dairy Science Association should make known their attitude in this matter.

The second matter for action by our association is relative to the establishment of an "Institute of American Biologists" which was proposed and discussed during the April meeting in Washington. Stress was put on the importance of not viewing such a new organization as just another society but to think of it as an operating agency to foster the betterment of biological workers in their political relationships with schools, industry, government and society in general.

Dr. Robert F. Griggs, Chairman of the Division of Biology and Agriculture, requested that a delegate representing the American Dairy Science Association be appointd to participate in a meeting which he will call some time in the near future to establish this institute. Dr. Nelson, our president, has been informed of this matter and will probably follow the desires of the Association members in any action he may take about it.

Respectfully submitted,

C. Y. CANNON

INTER-ASSOCIATION COUNCIL ON ANIMAL DISEASE AND PRODUCTION REPORT

As a result of the cancellation of meetings of some of the member associations during the latter stages of the war, there was little opportunity for the council to hold formal meetings.

Your representative is pleased to report, however, that the U. S. Live Stock Sanitary Association reconsidered the Council's program entitled "Promoting and Protecting the Welfare of the Livestock Industry" at their annual meeting in December, 1945, and gave it their hearty approval. Thus, the program stands approved by all the member organizations. At a meeting of the Council, to be held during the summer of 1946, appropriate steps will be taken to activate those portions of the program which are not currently being handled by other agencies.

It is gratifying to know that as a result of the recognition of the need for vital statistics, and stimulated in part by the council and the committee on Veterinary Services for Farm Animals of the National Research Council, the Iowa Experiment Station and the Agricultural Research Administration of the U. S. Department of Agriculture are conducting a pilot plant study on ways and means of obtaining vital statistics and the evaluation of the economic importance of current losses in production.

Your representative is also pleased to advise that the Agricultural Board of the National Research Council has favorably received the suggestion that a comprehensive study be executed on the relation of brucellosis to public health. It is expected that a report will be issued in due course.

The programs on animal production, which were developed at the request

of the Council and distributed by the National Livestock Conservation Program, are being discontinued in view of the fact that the latter organization is being liquidated.

There have been no changes in the membership of the Council during the past year. The financial condition of the Council remains unchanged, with a bank balance of $386.95. The fund has accumulated as a result of the action of the representatives who have refused to accept payment for operating expenses during the previous two years. In view of the fact that a reserve fund has been established, together with other considerations, the Council did not request additional contributions from the member associations for the year October 1, 1945, to October 1, 1946.

Respectfully submitted,

W. E. PETERSEN, *Representative to The Inter-Association Council*

The above report was given by Mr. Petersen and upon motion duly seconded was accepted.

NECROLOGY COMMITTEE

Harry W. Cave of the Necrology Committe read the following report, and upon motion duly seconded, it was adopted.

The Necrology Committee regretfully reports the following members as having passed away during the past year:

Martin Van Scheid was killed in action on Guam, July 29, 1944.

Arnold Lohmann was killed in action in Germany in December, 1944.

Daniel J. Luby died May 24, 1945.

Roscoe W. Clowes, born September 13, 1899, at Stockton, California, died June 5, 1945, at Stockton. He was owner of a dairy business and received a B.S. degree from the University of California in 1923.

Ralph Purdy Gingerich, born January 9, 1888, in Minonk, Illinois, died February 28, 1946, in Los Angeles, California. He was Market Milk Specialist for the California State Department of Agriculture and received a D.V.M. degree from Chicago Veterinary College in 1913.

Stanley M. Ross, 64, President of the M. & R. Dietetic Laboratories, Inc., and one of the founders of the Moores & Ross Company of Columbus, Ohio, died early Friday, March 22, 1946, at his winter home in Miami Beach, Florida. Recognized as one of the leading dairy figures in the United States, Mr. Ross and Harry Moores established Moores & Ross in 1903. In 1929, the company was acquired by the Borden Company and Mr. Ross became Mid-West district chairman of Borden's. He retained this position and also was a director and member of the executive committee of The Borden Company until his retirement because of ill health in 1939. Mr. Ross was president of the International Association of Ice Cream Manufacturers in 1928, was a principal organizer of the Ohio Dairy Products

Association, and was a director of the International Association of Milk Dealers.

Dr. Eraldo T. Bertonasco, 38, a member of the American Dairy Science Association, died at Rochester, Minnesota, on April 8, 1946, of a heart attack. Dr. Bertonasco was Vice-President in Charge of Production of the Stella Cheese Company. He was born in Vesime, Italy, in 1908, the son of Francis and Delfina Bertonasco. He was married in Turin, Italy, March 5, 1932, to Lydia Castigliano, daughter of Attilio Castigliano, President of the Stella Cheese Company.

Clarence B. Frink died July 7, 1945.

Respectfully submitted,

H. W. CAVE
G. A. RICHARDSON
D. R. THEOPHILUS, *Chairman*

RESOLUTIONS COMMITTEE

Mr. H. C. Jackson, Chairman of the Resolutions Committee, submitted the following report, and upon motion duly seconded, it was adopted.

WHEREAS: There is a growing relationship in our intercourse with foreign countries economically, culturally and otherwise, and

WHEREAS: The dairy industry in its various phases of production, processing and manufacturing is sharing in this relationship, and

WHEREAS: Exportation always has its problems in reference to quality and never more so than in the exportation of breeding animals from the standpoint of health, production, pedigree, individuality, adaptability, etc.,

Therefore, in view of the different problems, be it *Resolved:* That the American Dairy Science Association urge unusual care on behalf of purchasers so as to avoid putting the American dairy industry in ill repute in foreign lands.

WHEREAS: Iowa State College, through its administrative staff, its faculty, and especially the members of the Animal Husbandry and Dairy Industry Departments have made available to the American Dairy Science Association in this its 41st Annual Meeting all needed physical facilities for the meeting, and

WHEREAS: Every possible personal courtesy has been given to members of the asociation,

Therefore, be it *Resolved:* That the American Dairy Science Association take this opportunity officially to extend its thanks and appreciation and to request the President of this association to express this appreciation by letter to President Charles E. Friley and to Dean H. H. Kildee.

WHEREAS: The Borden Company has again considered it desirable to offer their award for outstanding research in dairy manufacturing and production,

Therefore, be it *Resolved:* That the American Dairy Science Association express to the company its sincere appreciation of this evidence of the continued and great interest in research, which plays such a vital role in the progress of our industry.

WHEREAS: The need is recognized for an effective and uniform milk inspection service, and

WHEREAS: The members of this association train individuals for this specialized service and advise producers and plant operators concerning methods which will result in the efficient production of wholesome milk and dairy products,

Therefore, be it *Resolved:* That the President of this association appoint a committee composed of representatives of the three branches of the association to determine the most effective methods of producing high quality milk and dairy products in the light of present day scientific knowledge.

F. W. ATKESON, E. L. FOUTS, R. V. HUSSONG,
I. R. JONES, H. C. JACKSON, *Chairman*

REGISTRATION COMMITTEE

Mr. E. F. Goss made the following report for the Registration Committee, and upon motion duly seconded, it was accepted.

Illinois	50	S. Dakota	6	Kentucky	3
Iowa	43	Kansas	5	Utah	3
Minnesota	30	Nebraska	5	Georgia	2
Wisconsin	29	Texas	5	Idaho	2
New York	28	Vermont	5	Louisiana	2
Ohio	27	Washington	5	New Hampshire	2
Michigan	19	W. Virginia	5	Oregon	2
Missouri	17	New Jersey	7	So. Carolina	2
Washington, D. C.	14	Connecticut	4	Wyoming	2
Pennsylvania	13	Massachusetts	4	Canada	2
Indiana	11	Montana	4	Arkansas	1
Maryland	10	Oklahoma	4	Maine	1
California	7	Virginia	4	North Dakota	1
Tennessee	7	Colorado	3	New Mexico	1
No. Carolina	6	Florida	3		
					406

Registration of members	406
Registration of non-members	126
Total registration	532
Women and children	225
Total attendance	757

Members from 42 states, the District of Columbia, and Canada were in attendance. Non-members attended from Belgium, China, Denmark and Sweden.

The Secretary then read the minutes of the Executive Board, and upon motion duly seconded, they were adopted. The Secretary then moved and it was seconded by O. F. Hunziker that all action of the Executive Board during the past year be approved.

MEETING OF THE EXECUTIVE BOARD AMERICAN DAIRY SCIENCE ASSOCIATION

R. B. STOLTZ, *Secretary-Treasurer*

The Executive Board transacted the following business:

Approved Editor's Report.

Approved Secretary-Treasurer's Report.

Approved and prepared a budget of $23,000 for the year 1947.

Approved the issuing of certificates for student branches of American Dairy Science Association.

Authorized the Secretary to purchase some back numbers of the Journals at $3.00 per volume.

Approved that our Association advise the Pure-bred Cattle Association that we will cooperate with the Dairy Cattle Research Association as is outlined in a letter from Mr. G. A. Bowling of January 8, 1946.

Approved the revised report of the Journal Management Committee as follows:

1st—Maintain the high scientific standard of the articles covering original work at all times.

2nd—Release abstracts or original articles to the press at the time the page proof of the article is sent to the publisher, the press consisting of trade journals in the various fields.

3rd—Encourage a greater number of good review articles.

4th—Add to the abstract section coverage of patent literature in the field of dairy and allied sciences.

5th—Recast present abstracts service looking toward:

(a) More extensive coverage.

(b) Better abstracts.

6th—Study the possibility of securing and publishing the British Dairy Abstracts.

7th—That the Editor study the Committee's recommendation concerning the conserving of space in the Journal including the additional possibility of changing the size of type and making a double column.

Approved that these recommendations go into effect on January 1, 1947.

Approved the Inter-Association Council Report.

Accepted the National Research Council Report.

Accepted tentatively an invitation from the University of Illinois to meet in Chicago in 1947.

Employed Secretary-Treasurer for the year 1947.

Made record of the report of nominating committee and results of election.

The following officers were elected:

PAUL H. TRACY, *Vice-president*
C. Y. CANNON, *Director*
S. J. BROWNELL, *Director*

Accepted the resignation of Editor T. S. Sutton and the employment of I. A. Gould as Editor to begin January 1, 1947.

AMERICAN DAIRY SCIENCE ASSOCIATION ANNUAL BANQUET

Ames, Iowa, June 20, 1946

Mr. C. Y. Cannon of Iowa State College was toastmaster at the annual Association banquet and presented President J. A. Nelson who installed the officers elect as follows: Mr. Fordyce Ely of Kentucky was installed as President, Mr. Paul H. Tracy of Illinois as Vice-President, Mr. C. Y. Cannon of Iowa and S. J. Brownell of New York (in absentia) as Directors.

"Mr. Ely, you are about to take over the responsibilities of President of the American Dairy Science Association. As president it will be your duty to be Chairman of the Executive Board and submit to the board for approval the nominations of members to fill vacancies that may occur among the elected officers of the Association. As president you shall appoint, without the approval of the Executive Board, the standing non-elective committees of the Association. With these obligations, privileges and responsibilities I now charge you with the honor of being President of the American Dairy Science Association with all the privileges, responsibilities and obligations pertaining thereto."

"Mr. Tracy, you are about to take over the responsibilities of Vice-President of the American Dairy Science Association. As vice-president, it will be your duty to preside over the Executive Board in the absence of the President and assume other duties of the Executive Board. At the expiration of President Ely's term, you will automatically become President of this Association. I now charge you with these duties."

"Mr. Cannon and Mr. Brownell (who has been called to Germany), you were elected to the Executive Board of the American Dairy Science Association. It will be your duty to pass on all applications for the establishment of divisions, sections and student branches of the Association. The budget will be under your control. You will have full control of the business of the Association and have title to all property and funds of the Association. You will be members of a Board that has all the rights and powers vested in the by-laws of the Association. With these privileges,

FORDYCE ELY, *President*

responsibilities and obligations you are now considered as members of the Executive Board of the American Dairy Science Association."

PRESENTATION OF ASSOCIATION AWARD

The toastmaster then introduced Mr. H. P. Davis, Chairman of the Association's Honors Committee. Mr. Davis then made the following citation:

A native of Missouri and educated in the schools of that state, he graduated from the University of Missouri and received also a Masters degree from that institution. Starting his research and teaching at his Alma Mater, he later continued his work at Purdue University before becoming Chief of the Dairy Department of the Kansas State College. Returning later to head the Dairy Department at Purdue, he left to become manager of a large Ayrshire farm. Again he entered the collegiate field as Chief of the Dairy Department of the Michigan State College. In 1928 when a chief for the Bureau of Dairy Industry of the United States Department was needed, he was selected and has filled and continues to fill that important position with ability and wisdom.

During the years his influence has been impressed upon the dairy industry in a multitude of ways. The early work with Eckles on growth of dairy heifers was a milestone and from that time on his energies have always been directed in bringing about more efficient methods for the dairy industry. He valiantly sponsored the Dairy Herd Improvement Association work in this country and made available the records thus obtained for use in selective breeding. Fundamental research has been carried on under his leadership in dairy cattle feeding, breeding, and management. Studies in the processing of dairy products have led to improvements in the manufacture of cheese, butter, ice cream, and powdered milk as well as in the more effective use of dairy by-products.

As a member of the United States delegations to the World's Dairy Congresses held in 1928, 1931 and as chairman in 1933 and 1937, he ably represented this country abroad and did much to familiarize foreign dairy workers with our dairy developments.

O. E. Reed is a member of many important organizations including the National Research Council, the American Association for the Advancement of Science, the American Society of Animal Production, the Dairy Federation, the American Dairy Science Association (past president), Alpha Zeta and Sigma Xi.

It is with a great deal of pleasure that I have the honor to present on behalf of the American Dairy Science Association this award of honor to you, Ollie Ezekiel Reed, an administrator, a scientist, and a teacher in the dairy industry.

OLLIE EZEKIEL REED

PRESENTATION OF BORDEN AWARDS

Mr. W. A. Wentworth of the Borden Company was then introduced and gave the purpose of their sponsoring these awards and introduced the recipients of the Borden Awards in Dairy Manufacturing and Production for the past nine years.

Borden Award in Dairy Manfucturing

Mr. H. F. Judkins, Chairman of the Borden Award Committee for Manufacturing was then introduced and made the following statement.

The recipient of the Borden Award in Dairy Manufacturing for this year is a practical dairy scientist who has made many notable contributions to our knowledge in the field of Dairy Technology, devoting most of his research to the field of market milk, ice cream, condensed milk and dried milk powder. He has been a pioneer in certain aspects related to these fields and he has contributed greatly to our knowledge of the use of the vacuum pan for making ice cream mixes; the study of homogenized milk problems; oxidized flavors in dairy products; the causes of shrinkage in ice cream; the factors affecting the feathering of coffee cream; the sanitary and physical properties of paper milk containers; the use of corn sugar and syrup in dairy products; and the keeping quality of sprayed dried whole milk.

He received his bachelor's, master's and doctor's degree from the University of Illinois in 1920, 1922 and 1930, respectively. It was the unanimous decision of the Borden Award Committee for Dairy Manufacturing that Dr. Paul H. Tracy be selected as the winning candidate.

In addition to his work in research, he has contributed much to the dairy industry, having formed the Chicago Dairy Technology Society in 1930 and has been its secretary since that time. He continues to be one of the leaders in research in dairy manufactures, and at the same time embraces the opportunity of translating the findings of his research to the layman.

From 1920 to 1946, Dr. Tracy has served in the Department of Dairy Husbandry passing from the rank of assistant to Professor, the position which he now holds. He has been active in the affairs of the Association as Secretary of the Manufactures Section in 1933; Chairman of the Manufactures Section in 1937; abstract editor of the JOURNAL OF DAIRY SCIENCE, Director, 1944–46; and Vice-president elect 1946.

Mr. Wentworth then presented to Mr. Tracy a gold medal and $1,000.

Borden Award in Dairy Production

Mr. J. B. Fitch, Acting Chairman of the Borden Award Committee for Production, was then introduced and made the following statement.

The Dairy Production Award Committee has unanimously selected as the

PAUL H. TRACY

winner of the Borden Award for 1946, Dr. Ezra Paul Reineke of Michigan State College.

Dr. Reineke received a B.S. degree with distinction from the University of Minnesota in 1934, majoring in dairy production with emphasis upon agricultural biochemistry. He then went to the University of Missouri for graduate work, receiving his Master's degree in 1936. From 1936 to 1937 he was in charge of the office of extension work of the American Jersey Cattle Club. He returned to the University of Missouri as an instructor in 1938 and received his Ph.D. degree in 1942 when he was promoted to assistant professor. In 1945 he was appointed assistant professor of Physiology and Pharmacology at Michigan State College.

He is author or co-author of 41 scientific publications including four Research Bulletins. These research publications deal with the precursors of the various constituents of milk and more recently with the synthesis of thyroprotein which has been found to favorably influence the secretion of milk in dairy cattle.

In connection with the study of milk precursors and the chemical transformations of blood constituents into milk, Dr. Reineke was the first to present direct evidence that a glycoprotein fraction of the blood was concerned in the synthesis of milk protein. As a result of studies on the mammary gland respiratory quotient of animals under various conditions, evidence was presented that suggest the synthesis of short-chain fatty acids by the mammary gland from carbohydrate precursors.

During the past five years his research has centered around the problem of determining the chemical conditions favoring the transformation of casein into synthetic thyroprotein. The initial iodinated casein preparations were about equal to desiccated thyroid in thyroidal activity. As a result of his studies, methods were developed which increased the thyroid activity of thyroprotein fifty times. It is interesting in this connection to note that although intensive study was given to the problem of thyroprotein synthesis in England during the War years, they reported in 1945 that Reineke's methods had not been improved upon. At least one-third of the total tyrosine in casein has been converted to thyroxine by his methods.

Thyroprotein is the first hormone substance which bids fair to earn for itself an important place not only in the dairy industry in stimulating increased milk and fat production when administered in the dairy ration, but in all branches of the livestock and poultry industries. Preliminary observations with thyroprotein indicate that this product may also become of importance in problems of sterility of livestock.

One of the important problems in the use of thyroprotein is the problem of standardization. Dr. Reineke developed a chemical method for the determination of the thyroxine content as well as several biological methods which will aid in producing a uniform product.

E. P. REINEKE

Dr. Reineke is not only a brilliant scientist but by birth and experience, he is a practical dairyman. He was born and raised on a dairy farm. He earned his college expenses by caring for the University experimental herd. He was in charge of the office extension work of a national breed association.

Dr. Reineke has those unusual and outstanding qualifications for a recipient of the Borden Award. He is young, has a brilliant record of scientific contributions and a background of practical experience and application. We believe that in the years ahead of him, he will add many and even greater contributions to dairy science.

Mr. Wentworth then presented to Dr. Reineke a gold medal and $1,000.

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ABSTRACTS OF LITERATURE

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JOURNALS

American Butter Review
American Milk Review
American Journal of Diseases of Children
American Journal of Physiology
American Journal of Public Health
Archives of Pediatrics
Australian Journal of the Council for Scientific and Industrial Research

Biochemical Journal

Canadian Dairy and Ice Cream Journal
Canadian Journal of Public Health
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Certified Milk
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Southern Dairy Products Journal

SPECIAL PUBLICATIONS

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International Association of Ice Cream Manufacturers
International Association of Milk Dealers

National Institute for Research in Dairying, Reading, England
New York Association of Dairy and Milk Inspectors

Prussian Dairy Research Institute, Kiel, Germany

State Agricultural Colleges and Experiment Stations

The Royal Technical College, Copenhagen, Denmark

United States Department of Agriculture

ABSTRACTS OF LITERATURE

BOOK REVIEWS

223. Secretion of Milk, Third Edition. DWIGHT ESPE. The Collegiate Press Inc., Ames, Iowa. 314 pp., illustrated.

Many of the readers of the JOURNAL OF DAIRY SCIENCE will welcome the third edition of this important work. Those who have used the previous editions in their teaching or research work or who have it in their library as a source of information will appreciate the author's effort in keeping this book abreast of progress in a fast-moving field. The number of literature citations has been expanded to include 1,294 references which is almost double the number of the original edition which appeared in 1938. This is striking evidence of the interest and progress in the field. T.S.S.

224. Water Bacteriology. S. C. PRESCOTT, C.-E. A. WINSLOW AND M. H. MCCRADY. 368 pp. 6th Ed., 1946. $4.50.

The sixth edition of this standard text and reference book on sanitary water bacteriology is organized almost like the fifth edition but is brought up to date and considerably enlarged, with three more chapters, 145 more pages and 46 more tables. To the authors of previous editions, Doctors Prescott and Winslow, has been added another eminent water expert, Dr. M. H. McCrady, who had much to do with the latest revision of the book. Again the discussion is built about the latest edition of "Standard Methods of Water Analysis." Both official and unofficial methods are analyzed and interpreted and special attention is paid to the differentiation of the various coliform bacteria and the use of selective culture media. Emphasis is placed on the quantitative expression of results of the presumptive test and an appendix includes tables for obtaining the most probable number. The latest methods for examination of sewage and sewage effluents and of shellfish are brought up to date.

This edition, like earlier ones, deals only with the public health aspects of water bacteriology and does not discuss the general bacteriology of natural waters.

All workers on sanitary water bacteriology will welcome this new edition as will teachers of the subject. W.C.F.

BACTERIOLOGY

225. Thermoduric and Thermophilic Bacteria in Dairy Products. W. E. NOYES, Canadian Dairy and Ice Cream Jour., *25*: 2. Feb., 1946.

Thermoduric bacteria are heat-resisting microorganisms, approximately 90% of which survive ordinary pasteurization temperatures. Thermophilic

bacteria are not killed at pasteurization temperatures but actually grow at these temperatures. Thorough removing of milkstone and subsequent cleaning and disinfecting of all utensils is necessary for complete control of these bacteria. There are two classifications for milkstone in the plant: (1) presence of milkstone is due to faulty cleaning methods and (2) from the formations of milkstone due to daily operations of specific types of equipment. To eliminate milkstone the use of proper cleaning products is necessary and the personnel should be shown how to properly clean the equipment and keep it milkstone-free. Manufacturers' directions should be followed on cleaning plate type short-time pasteurizers. Can washers should be in good working order to eliminate this operation as a factor in milkstone formation. Milk should not be repasteurized, as heat-resisting and heat-loving bacteria thrive on this treatment. Other precautions are to: (1) eliminate any dead ends on the sanitary piping and (2) control foam on pasteurization equipment.

Chlorine products, both in the plant and on the farm are effective in eliminating high counts due to these organisms. If these bacteria are not found in the plant, look to the farm for potential breeding places in milking machine. H.P.

BREEDING

226. Studies on the Metabolism of Semen. 1. General Aspects. Occurrence and Distribution of Cytochrome, Certain Enzymes and Coenzymes. T. MANN, Molteno Institute, University of Cambridge (England). The Biochem. Jour., *39*, No. 5: 451–458. 1945.

The ejaculated semen of the ram, bull, and boar were used for the study but most of the results are reported for ram semen. Emphasis is placed upon the difference between the metabolic characteristics of the spermatozoa and the seminal plasma and a procedure for the separation of the two is included. It is demonstrated that the spermatozoa contain a complete cytochrome system. Some evidence is given for the presence of adenosinetriphosphate in the spermatozoa and that its function as a coenzyme is in some way connected with motility. Mention is made of deaminases and phosphatases. A.O.C.

227. Studies on the Metabolism of Semen. 2. Glycolysis in Spermatozoa. T. MANN, Molteno Institute, University of Cambridge (England). The Biochem. Jour. *39*, No. 5: 458–465. 1945.

The enzyme systems involved in the carbohydrate metabolism of spermatozoa are studied. It seems that the reactions involved resemble those which take place in other tissues and in yeast metabolism. A.O.C.

228. Die Haltung der Zuchtstiere. W. ENGELER, Herdbook Office for Brown Swiss Cattle, Zug, Switzerland. 107 pp., 42 halftones, 20 graphs. Verbandsdruckerei AG, Bern. 1943.

An account of the conditions and laws under which Brown Swiss bulls are kept in Switzerland. Besides decribing the ownership, feeding, management, fees for service, etc., there is an analysis of the vital statistics for bulls as revealed by the records in the herd-book office. These statistics are analyzed for such things as the age composition of the bull population, age when service begins, age when sold for slaughter, causes of slaughter, number of services per unit time, conception rates, number of offspring marked per year, etc. Breeding associations own 33% of the bulls outright and rent about 25%. The other slightly more than 40% are entirely in private possession. The associations buy 65% of their bulls at the national show, 34% at local shows or from local breeders, and 1% from other associations. The average age of the living bulls is 1.8 years. The average age of bulls when sold for slaughter is 3.4 years. The average bull makes 280 services during his lifetime, which is 12.3 per month of effective breeding use. On the average 31 calves per bull are marked by the herdbook officers; only 15% have more than 50 such calves each. The number of services is 1.44 times the number of different cows served but, since some of these cows do not actually calve, the actual conception rate would be lower than the 69% which this appears to equal. J.L.L.

229. Das Photographieren Landwirtschaftlicher Haustiere. Edited by W. ENGELER. Schriften Nr. 5 der Schweiz. Vereinigung für Tierzucht. 24 pp. 17 illustrations. Verlag Benteli AG., Bern. Fr. 2.40. 1944.

A symposium of seven lectures given at a short course in animal photography held by the Swiss Society for Animal Breeding at the Strickhof school near Zurich in April, 1944. The brief articles cover such topics as the purposes of animal photography, suitable equipment, suggestions on the making of negatives and positives, proper placing of the animals and choice of backgrounds, and special details concerning photography of horses, cattle, and smaller animals. J.L.L.

230. Untersuchungen über die Inzucht- und Verwandtschaftsverhältnisse und ihre züchterischen Auswirkungen in Hochzuchtgenossenschaften des schweizerischen Braunviehs. W. ENGELER AND P. INDERMÜHLE. Herdbook Office for Brown Swiss Cattle, Zug, Switzerland. Landwirtschaftlichen Jahrbuch der Schweiz. pp. 954–980. 1944.

The Brown Swiss cattle born in 1940 or earlier in the breeding associations of Sachseln and Elm were studied to learn how much inbreeding had

been done, what direction it had taken, and what the results had been. The average inbreeding was only 2.22% in Sachseln and 0.86% in Elm. The average relationship of the present male animals to each other was 6.6% in Sachseln and 5.4% in Elm. Since this is more than twice the inbreeding coefficient, it appears that the average breeder made some effort to avoid inbreeding.

Detailed study of Sachseln showed that about three-fourths of the inbreeding there was to two bulls, Baron and Figi, unrelated to each other and both used extensively several generations ago. Apparently the inbreeding was not deliberately intended as such, but resulted incidentally from a widespread striving to save and use the descendants of these two bulls. The present Sachselen animals carry 13.1% of the blood of Baron and 11.0% of the blood of Figi. From this it may be presumed that about one-fourth of the genes in the present Sachseln population come from these two individuals. No clearer relation was found between the conformation score and the intensity of inbreeding of the individual animals. Since the range in inbreeding was not wide, clear evidence of such a relation was hardly to have been expected unless the relation was very close. J.L.L.

BUTTER

231. Neutralization and Acidity Control in Creamery Butter. D. L. Gibson, Canadian Dairy and Ice Cream Jour., *25*: 4. April, 1946.

The article gives: (1) a review of the proper procedure and sequence to follow in neutralization, and (2) a discussion of the underlying factors which control pH and acidity. It has been found that, all things being equal, butter with a pH ranging from 6.7–7.2 has the best keeping quality. To obtain proper pH, (1) the type of neutralizer used is one of the main points to be considered when neutralizing cream; and (2) the titration on a vat of raw cream should be done with extreme care and a standardized method followed. Other minor factors that may affect the pH are, (1) the season of the year may affect the titratable acidity; (2) the percentage of fat in the cream, and (3) the amount of dissolved carbon dioxide in the raw cream. The method for measuring the pH of butter serum is outlined. H.P.

232. New Buttermaking Processes Used in German Creameries. W. H. Cook, Canadian Dairy and Ice Cream Jour., *25*: 3. March, 1946.

The Fritz process continuous buttermaker is described and diagrammed. It consists essentially of three parts: (1) horizontal water-jacketed drum with paddles that revolve at 2,850 r.p.m.; (2) pressing chamber consisting of two worm screws rotating at 60 r.p.m., and (3) succession of single turn worm screws separated by perforated plates. For this machine the milk

is separated at a temperature of about 110° F. to produce 45–50% cream. The cream is flash pasteurized and cooled to 40° F. in a holding tank. From this tank it is pumped to the constant level tank supplying the butter machine. The fat content of the butter is influenced by: (1) initial fat content of the cream; (2) temperature of the cream; (3) rate of flow; and (4) the adjustment of the orifice in the machine. The butter is not washed by this method. Small units have a capacity of 990 pounds per hour while larger units make almost two tons per hour.

Another process for continuous buttermaking is the Alpha process. It is essentially a two-stage centrifugal process. The incoming milk is brought to a temperature of 85° C. (185° F.) in a pasteurizer and is passed at this temperature to the first separator which delivers cream containing 30% butterfat. This fat-rich fraction is cooled continuously in an enclosed shell-and-tube cooler to a temperature of 65° C. (149° F.) and at this temperature is passed through another centrifugal separator that delivers a cream fraction containing 80% butterfat. This fraction is immediately cooled in a special cooler, fitted with a screw expeller to room temperature or lower, and is delivered as butter. The butter is not salted. The largest unit of this type produced 550 pounds per hour, and some dairies have two or three units. The butter differs somewhat in physical properties from butter produced in the churn. A picture of an automatic cheese-making machine which completes the cheesemaking process without manual handling of the product during processing is shown. H.P.

233. Report of Studies on the "Winter" Flavor of Butter. A. H. WHITE AND C. A. GIBSON, Canadian Dairy and Ice Cream Jour., *25:* 3 and 4. Feb. and March, 1946.

Studies were made of the effect of the stage of lactation and methods of handling cream and milk on the lipase actions in cream in relation to the development of bitter or "winter" flavor in the cream and butter. When cows were fed a well-balanced ration containing succulent feeds and the milk and cream were handled according to the best recommended methods, stage of lactation was not an important factor in lipase activity and the development of "off" flavors.

Lipase activity in winter cream as indicated by titratable acidities of the cream, fat acid values of fresh butter, and the flavor quality of both cream and butter, was promoted and accentuated by cooling and rewarming the milk before separation and by the addition of warm cream to cold cream.

Considerable bacterial growth takes place in cream held at 35° F. or lower, especially when warm cream is added to previously collected cold cream, and air cooled at a temperature of approximately 30° F.

To obtain and maintain the highest flavor quality in winter cream and butter, milk should be separated as soon after milking as possible and each

lot of fresh cream should be cooled before being added to cream previously collected and cooled. H.P.

234. La Graduation des Butyromètres a Crème Un Nouveau Modèle de Butyrometre. (Graduation of Cream Butyrometers. A New Model of Butyrometer.) JEAN PIEN. Le Lait, *24:* 234–236. 1944.

In the Gerber method of determining butterfat, samples are digested with sulphuric acid and amyl alcohol. For cream the sample may be weighed and diluted 10 times in order that a milk butyrometer may be used. This practice multiplies errors. Errors also result from calibration of glassware at 20° C. while it is actually read at much higher temperature, inaccuracies in reading the meniscus and destruction or removal of soluble fatty acids in the acid-alcohol-water phase. A new butyrometer designed to give results directly in fat per kilogram of cream using a 5-gram sample or alternatively, the richness of cream per liter of a 5-cc. sample, is described. O.R.I.

235. Donnees Techniques sur la Beurrerie Francaise. (Known Techniques Applied to the French Creamery.) A. HOUDINIERE. Le Lait, *24*: 231–233. 1944.

The methods used in assessing quality in French butter are outlined and the results of chemical and microbiological tests on 228 samples are presented. These indicate a need for greatly improved composition and pH control as well as more efficient pasteurization and better buttermaking methods. The reasons for defects are discussed and the necessity for improved training of buttermakers stressed. A more adequate inspection system is also advocated. O.R.I.

236. Etude de la dilution des crèmes et son influence sur la composition des babeures. (Study of Dilution of Creams and Its Influence on the Composition of Buttermilks.) JEAN PIEN, Le Lait, *23*: 224–226. 1943.

Watering cream is undesirable for several reasons but particularly where the buttermilk is to be dried. The author develops mathematically the effect of varying rates of dilution upon the composition of creams and upon the resulting buttermilks. O.R.I.

237. What's Ahead for the Butter Industry? H. A. BENDIXEN, State College of Washington, Pullman. Nat. Butter & Cheese Jour., *37*, No. 4: 42. April, 1946.

The potential butter market is large. Future competition will be keen.

Efficient production on farms and in factories can improve quality and effect economies in utilization of labor. Better machinery for churning, product handling, can washing and refrigeration will help. Plant costs may be reduced by production of such diverse products as dry skim milk and buttermilk, soluble casein and butter oil. Management will do well to improve its labor relations through vacations, insurance plans, recreational programs, safety devices, and rest rooms. W.V.P.

CHEESE

238. Why Canadians Are Low Cheese Consumers. P. H. CASSELMAN, Canadian Dairy and Ice Cream Jour., *25:* 3. March, 1946.

The temperature zone climate in Canada is such that cheese does not lend itself to hot meals. However, if proper organization and education were used, cheese consumption could be greatly increased. In Canada in 1934, the per capita cheese consumption was 3.6 pounds while most other countries averaged (1932–1934) from 4.0 to 19.2 pounds per capita. H.P.

239. Utilization of Whey for Profit to Producer and Manufacturer. D. H. MCCALLUM, Canadian Dairy and Ice Cream Jour., *25*: 3. March, 1946.

Whey must not be drained into rivers or pools to produce pollution of streams and create a public nuisance and health hazard. Whey can be made a source of revenue shared by both cheesemaker and patron. Whey solids consist of valuable proteins, milk sugar, minerals, and vitamins. Whey makes an excellent feed for hogs. It is worth about one-half as much as skim milk fed to hogs either on pasture or in dry lot. One hundred pounds of whey is equivalent to approximately one-quarter bushel of corn or in protein value to eleven pounds of barley. Clean fresh whey may be fed to calves. The whey should be pasteurized, obtained fresh each day and fed in clean pails (pasteurization is necessary if all milk does not come from tuberculin-tested cows). Whey can be used as a substitute for mineral acid or molasses in making grass silage. Three to five hundred pounds of whey should be used per each ton of grass. Dried whey can also be used as a human food in candy, processed cheese, cheese spreads to replace skim milk powder and in the manufacture of penicillin. H.P.

240. Utilisation des Sérums de Fromagerie et des Lacto-Pretéines dans L'alimentation. (Utilization of Cheese Factory Whey and Milk-proteins as Foods.) JEAN PIEN. Le Lait, *23:* 227–228. 1943.

The value of whey and its products as an article of diet is extensively reviewed, particular emphasis being given to the effect of acidity and

neutralization of the whey upon mineral values. Experimental values with respect to the effect of heating wheys of varying acidities result a reduction in ash content. It is concluded that the use of whey products as human food should be increased, preferably in the form of whey cheese. The need for improved sanitary methods of handling and manufacturing whey products is stressed. O.R.I.

241. **Le Sérac (a whey cheese).** A. HOUDINIÈRE. Le Lait, *23*: 229–230. 1943.

A description is given of the principles involved in the manufacture of a cheese similar to Ricotta. Sweet or neutralized whey from Gruyere or Camembert cheese is heated rapidly to within a few degrees of boiling, after which vinegar or sour whey is added and the curd which comes to the surface is collected and drained. It is usually sold fresh and may be mixed with condiments. The moisture content is 75–80%. O.R.I.

CHEMISTRY

242. **Differential Adsorption of Pepsin and Rennin on Foam.** G. ANDREWS AND F. SCHUTZ. Abstract of paper read at the proceedings of the Biochemical Society (London), Sept. 28, 1945. The Biochem. Jour., *39*, No. 5: li and lii. 1945.

"The relative adsorption on foam of these enzymes has been studied, not so much to find a new way of purification, but to show that by investigations of this kind differences in the surface activities of enzymes, present in the same solution, can be detected." Foaming was carried out by introducing nitrogen at a low rate through a gas jet with an opening of 50 microns diameter. Beginning with a solution with a 1:1 concentration of pepsin and rennin, a concentration of 7.4:2.6 was achieved. From this it is concluded that pepsin is considerably more surface active than rennin.

A.O.C.

243. **Rennet Hysteresis and the Calcium Phosphate of Milk.** G. T. PYNE, Dept. of Dairy Chemistry, University College, Cork (England). The Biochem. Jour., *39*, No. 5: 385–390. 1945.

When milk is heated the time required for coagulation by rennet is increased. This phenomenon is referred to as rennet hysteresis by the author. The cause is believed to be "a heat-induced displacement of the equilibrium between calcium phosphate in solution and the colloidal calcium caseinate–calcium phosphate complex," with the heat converting some of the soluble calcium and soluble phosphate to a less soluble colloidal complex. The reverse of this reaction on cooling (less soluble complex to the more soluble calcium and phosphate) is slow and only partly completed.

Conductivity measurements, made after the removal of most of the chlorides by dialysis, showed an interesting parallel trend to the time required for coagulation by rennet. A.O.C.

CONCENTRATED AND DRIED MILK: BY-PRODUCTS

244. La Caseine du Soya (glycinine) est-elle de la Caseine? (Is "Casein" of Soya Bean Casein?) MAURICE BEAU. Le Lait, *24*: 234–236. 1944.

The question is raised whether soya "milk" and soya "cheese" may legally be designated as such since milk, cheese, butter, cream, etc., are, in France, exclusively animal products from a legal point of view. The composition of soya protein and casein, while of similar elementary composition, differ considerably in their content of valine, proline, tyrosine, histidine and lysine. Methods of extracting the protein of soya beans vary considerably, however. Because of a lack of similar properties it is concluded that the term "casein" should not be applied to soya or vegetable proteins. The term "legumine" is suggested as a suitable one to designate the general class of proteins obtained from peas, beans, soyas, etc. O.R.I.

245. Le Sechage de la Caseine par Rayonnement Infrarouge. (The Drying of Casein by Infra-red Irradiation.) MAURICE DERIBERE. Le Lait, *23*: 229–230. 1943.

Experimental results are presented indicating that infra-red lamps are effective as a method for applying heat in the drying of casein. Curves are presented showing that casein curds lose up to 75% of their moisture in 3 hours when spread 2 cm. thick, and mashed every quarter hour. Irradiation was at the rate of 0.42 watts per sq. cm. A good product is produced and the method lends itself to continuous operations. On a cost basis it is competitive with tunnel drying. O.R.I.

DISEASE

246. Le Rôle du Lait dans la Transmission de Quelques Protozooses. (The Rôle of Milk in the Tranmission of Some Protozoa.) A. HENERY AND J. GUILHON. Le Lait, *24*: 231–233. 1944.

The literature relating to the transmission of such protozoa infections as Trypanosomosis, Leishmaniosis, Spirochetosis, etc., is reviewed. Milk other than that of the bovine species is involved in many instances. O.R.I.

247. Penicillin and Mastitis Control. C. S. BRYAN, Dept. of Surgery and Medicine, Michigan State College, East Lansing, Michigan. Milk Plant Monthly, *35*(2): 27–28, 65. 1946.

The author points out that mastitis can be classified as acute or chronic.

The acute mastitis may be divided into acute local mastitis and acute systemic mastitis, the former being mastitis having symptoms of swelling, pain and the production of milk of abnormal physical appearance, while the latter is characterized by a visibly sick cow, in addition to the abnormal symptoms in the udder. Chronic mastitis is usually characterized by the absence of any painful swelling in the udder and by decreased production of milk of normal physical appearance. Because of these variations of mastitis a cow may be infected for some time before the owner is aware of the presence of the disease. Udder diseases likewise may be classified as non-infectious and infectious from the standpoint of cause. The author presents in diagrammatic form the interrelationship between the cause and the effect on the cow and her udder. In determining the cause of mastitis, while physical examination of the udder and milk are valuable, bacteriological procedures must be applied to properly collected milk samples to make specific diagnosis of infection. The dairyman is urged to consult his local veterinarian early if mastitis is suspected. In the control of bovine mastitis the following items should be carried out in order:

A. Good sanitary milking procedures. (1) Arrange cattle into healthy, suspicious and infected groups, and milk the cows in that order. (2) Wipe udder one minute before milking with a clean cloth moistened in 200 p.p.m. chlorine solution. (3) Discard the foremilk into a strip cup. (4) Do not permit persons with sores on hands or "strep" throats to milk the cows. (5) Dip the teat cups into a pail of chlorine solution before milking each cow. (6) Milk each cow rapidly and completely at each regular milking period.

B. Good, sanitary herd management procedures. (1) Treat all udder and teat injuries promptly. (2) Stable cows in properly constructed stalls and stanchions. (3) Clean and disinfect all stalls after removal of infected cows. (4) Keep the barn dry and permit plenty of sunshine. (5) Practice good heifer calf raising thus preventing early udder injury. (6) Replace cows through (a) home raising (b) purchase of bred heifers (c) purchase of mature milking cows, testing all replacement cows before purchase.

C. Early and accurate diagnosis. (1) Careful physical examination. (2) Microscopic test.

D. Elimination by slaughter or by complete segregation. (1) No response to udder infusion treatments. (2) Confines or eliminates the spread of infection.

E. Early proper treatment. (1) By early treatment a high percentage become free from infection. (2) Udder infusions valuable only when infection is cause of mastitis.

Penicillin, an antibiotic agent obtained from cultures of the mold *Penicillium notatum*, is a very potent agent against gram-positive bacteria, which is the cause of the greater percentage of infectious mastitis. The

penicillin must be administered by a veterinarian. While this product cures many cases of infectious mastitis, the responsibility for the prevention of its re-occurrence remains on the shoulders of the dairymen. G.M.T.

FEEDS AND FEEDING

248. Seasonal Variation of Carotene and Vitamin A in Butter-Fat and in Serum. J. W. LORD, Research Department, Messrs. J. Bibby and Sons, Ltd., Liverpool. The Biochem. Jour., *39*, No. 4: 372–374. 1945.

A herd of 70 Ayrshire cattle four to five years old and at various stages of lactation was used for the investigation. The butter-fat determinations cover a period of two years, and the serum determinations a period of ten months.

Of the total vitamin A activity of the butter-fat (carotene plus vitamin A *per se*), carotene accounted for 28% during pasture feeding and 20% or less while the animals were in stalls. The average values of the total vitamin A activity in International Units per gram of fat were 31 for pasture feeding and 15 for stall feeding. The maximum was reached in May and June and the minimum during the last half of February to the first part of April.

Blood serum determinations showed a maximum carotene content of 1.35 mg./100 ml. during pasture feeding and a minimum of 0.23 mg./100 ml. for stall feeding. The vitamin A values for the same periods were 150 and 31 International Units/100 ml. respectively.

"The results indicate that pasture-feeding even for only a few hours a day maintains high levels of carotene and vitamin A in both butterfat and serum." A.O.C.

249. Studies in the Chemistry of Grass Silage. J. G. ARCHIBALD, Jour. of Agr. Res., *72*: 8. April 15, 1946.

Forty samples of silage, representing various crops and treatments were analyzed to determine moisture content, pH values, total nitrogen, water-soluble nitrogen, carotene, volatile bases, total acidity, amino acids, lactic acid, acetic acid (total and free) and butyric acid (total and free). Nine samples of fresh green crops were also analyzed before ensiling which corresponded in identity with certain of the silages.

Variations due to the kind of crop used were more significant than those due to the action of the preservative. Legume silages had a lower pH value and higher total acidity than silages made from grasses or small grains. Legume silages had a high lactic acid content while the others showed relatively large amounts of acetic and butyric acids. Of the preservatives used, molasses and ground wheat seem to have been the only ones at all effective.

Salt and lactic acid cultures were in many respects inferior to no preservative at all. Urea was entirely unsatisfactory for the purpose. High carotene values did not necessarily characterize silages that were of good quality in other respects. Carotene losses in some of the large silos were excessive.

Silages made from wilted alfalfa was quite different in composition from that made from the unwilted crop. Losses in total nitrogen, as indicated by determining this element in both the fresh and the dried ground samples, were variable, being much higher in the silages than in the corresponding green crops. Certain preservatives (molasses and ground wheat) tend to minimize this loss. H.P.

FOOD VALUE OF DAIRY PRODUCTS

250. The Importance of Milk in the Health of the Nation. FREDERICK TISDALL, Canadian Dairy and Ice Cream Jour., *25*: 3. March, 1946.

Milk and its products must be the basis of all diets if humans are to consume the amount of riboflavin and calcium needed for good growth and health, has been determined by the R.C.A.F. doctors. H.P.

251. Fluorescence Aids in Studying the Quality of Dairy Products. JESSE A. PEARCE, Canadian Dairy and Ice Cream Jour., *25*: 1. January, 1946.

A laboratory photoelectric fluorometer is described and diagrammed showing its operation. The vitamin content and quality of dairy products has been determined with this apparatus. The vitamins that fluoresce are vitamin A, vitamin B_2, and vitamin K; while vitamin B_1 and vitamin D, when treated with certain chemicals can be made to fluoresce. Fluorescence analyses have been used to detect adulteration of butter with other fats and the adulteration of cream. It can also be used to detect the source of dirt or external contamination of liquid milk. Fluoresence analysis of milk powders indicate that changes in palatability values could be correlated with changes in fluorescence. Fluorescence analysis in other dairy products studied were whey and cheese. H.P.

252. Sur la Resistance des Vitamines a L'Action de la Chaleur. (On the Resistance of Vitamins to the Action of Heat.) JEAN PIEN. Le Lait, *24*: 231–233. 1944.

This subject is reviewed but the literature cited contains no reference more recent than 1936. O.R.I.

253. Sur la Composition et le Rendement Énergétique du Lait de Femme en Periode de Restriction. (On the Composition and Energy

Value of Woman's Milk in a Period of Restricted Food Intake.) JACQUES LAVAGNE AND SOLANGE MATHIEU. Le Lait, *23*: 229–230. 1943.

Samples were secured from each of 13 subjects on the 5th, 8th, and, 11th days and analyzed for fat, lactose, casein and albumin, dry matter, phosphorus and calcium. From these data energy values and Ca/P ratios calculated. While the results were highly variable, it is concluded that the fat content is on the average reduced, lactose remains constant, and the caloric value reduced 21%. On the other hand, the Ca/P ratios were generally increased. This was a result of the calcium content being frequently above normal while in 19 cases out of 33 the phosphorus content was inferior to normal. O.R.I.

254. Teneur du Lait de la Vache en Vitamine PP. (Vitamin PP Content of Cow's Milk.) MADELEINE MOREL AND J. BARATTE. Le Lait, *23*: 224–226. 1943.

The nicotinamide content of a cow's milk was determined microbiologically over a period of about five weeks during the course of which the ration was varied. Results indicated that the milk usually contained about 0.2 mg. of vitamin PP per 100 ml. and was not markedly affected by changes in ration. O.R.I.

255. Ice Cream—A Nutritious and Delicious Food. E. A. GRANT, F. F. TISDALL, E. W. MCHENRY. Canadian Dairy and Ice Cream Jour., *25*: 2. Feb., 1946.

The amounts of protein, fat, carbohydrate, calcium, vitamin A, thiamine, and riboflavin in fourteen samples of commercial ice cream from five Ontario cities have been determined representing approximately 90% of the total commercial ice cream of the Province. A summary of the results follows:

Nutrient	Range	Average
Protein (%)	4.5– 5.6	5.0
Fat (%)	9.8–10.8	10.3
Carbohydrate (%)	15.5–21.2	17.6
Calcium (mg. per 100 g.)	130–180	150
Vitamin A (I.U. per 100 g.)	400–800	520
Thiamine (mg. per 100 g.)	50– 85	65
Riboflavin (mg. per 100 g.)	200–300	240

Data is also presented giving the comparison of some nutritive elements present in 75 grams of ice cream compared with the same nutritive elements present in other desserts served by restaurants. H.P.

ICE CREAM

256. Lessons of the Past Four Years. RIDGWAY KENNEDY, JR., Abbotts Dairies, Inc., Philadelphia. Ice Cream Trade Jour., *42*, 4: 48. April, 1946.

Reduction in truck mileage imposed by ODT orders proved that pre-war frequency of delivery service was unnecessary, wasteful and most expensive. This lesson has resulted in loading trucks to their actual capacity, covering about ½ the pre-war mileage and still giving ample service to dealers.

Another saving has resulted from a reduction in the number of flavors of bulk ice cream carried in stock. The number was reduced from 15 in 1941 to 7 in 1946.

These 2 factors, reduced frequency of delivery and reduced number of flavors, have made a saving in delivery costs without which we never would have absorbed the constant rise in costs of dairy products and flavoring supplies, with selling prices frozen by OPA at March, 1942, level.

Other economies which the war brought about were reduced cost of cabinet service, savings in signs and outdoor advertising cost, and a reduction in personnel in the sales department. W.H.M.

257. Bulk Gallon Sales for the Home. Ice Cream Trade Jour., *42*, 3: 24. March, 1946.

The Breyer Ice Cream Company of Philadelphia, Pennsylvania, has been experimenting with a single gallon bulk package for home consumption.

The container has inside dimensions of $6\frac{3}{4}''$ diameter, $6\frac{7}{16}''$ deep, with the well-known Breyer trade mark imprinted on it, together with instructions on how to handle the ice cream. It retails for $1.75 per gallon.

Sales have been good, during November and December, when this item accounted for 5.8 per cent of the total sales in the area where it was introduced. W.H.M.

258. 1945 Gallonage Hits All Time High. VINCENT M. RABUFFO. Ice Cream Trade Jour., *42*, 4: 42. April, 1946.

Estimated ice cream production for 1945 was 471,265,000 gallons, compared with 445,234,000 for 1944, an increase of 5.8 per cent. The increase was most marked after the WFO–8 was revoked in September when production for Sept., Oct., Nov., and Dec. went up 37, 47.4, 49.7, and 49.3 per cent, respectively.

The ten leading states in production were Pennsylvania, New York, California, Ohio, Illinois, Texas, Michigan, Massachusetts, Indiana, and Missouri. These states produced 60 per cent of the total volume. W.H.M.

259. A New Cellulose Gum Stabilizer for Ice Cream. D. V. JOSEPHSON AND C. D. DAHLE, Penna. State College. Ice Cream Rev., *28*, No. 11: 32. June, 1944.

Sodium carboxymethylcellulose (C.M.C.) is a tasteless, odorless, cellulose derivative possessing good water-binding properties and other characteristics which give it promise as a new ice cream stabilizer. This article contains the original experimental results indicating its unusual performance in ice cream manufacturing. When used in concentrations of 0.15 to 0.2 per cent of the mix it imparted good texture and a "chewy" body to the finished ice cream. This amount of C.M.C. also enhanced the whipping properties of the mix, a characteristic which is extremely desirable when natural emulsifying agents are lacking, as is the case when frozen cream is used in the mix. The synthetic product is said to be harmless physiologically. J.H.E.

260. Use of Dried Eggs in Ice Cream. CARL FRISCHKNECHT, War Food Administration. Ice Cream Rev., *28*, No. 10: 41. May, 1944.

There has been a great expansion of egg-drying facilities during the war. There were only 16 egg-drying plants in this country in 1941 compared to 121 in 1944. A total of 7,487,000 pounds of dried eggs were produced in 1940 compared with a total of 320,742,000 pounds in 1944. Anticipating a sharp drop in overseas demand for dried eggs, the author suggests the possibility of greater use of eggs in ice cream and reviews the advantages of eggs in ice cream. J.H.E.

261. Technical Literature of Ice Cream for 1944. ALAN LEIGHTON, Bureau of Dairy Industry. Ice Cream Rev., *28*, No. 10: 38. May, 1944.

This is an excellent bibliography of all the technical literature on ice cream published in 1944. There are 190 references arranged according to subject matter. J.H.E.

262. Ice Cream Manufacturing Problems. R. J. RAMSEY, Ramsey Laboratories, Cleveland, O. Ice Cream Rev., *28*, No. 11: 38. June, 1944.

One of the most common operating problems found in ice cream plants is the difficulty caused by a collection of ice under the blades and in the heads of continuous freezers. This ice appears in the form of tiny crystals, which are gathered together by the agitation and which form a grainy or lumpy appearance as the ice cream emerges from the freezer. Low total solids, low stabilizer, mixing ice cream coming from two freezers, excessive pressure in discharge line from freezers caused by too many elbows or lines

which are too long, and mechanical troubles with the freezer, are among the causes listed.

In the matter of sugar, during this period of scarcity, most plants are trying to maintain a sweetness of approximately 13.5%. It has been found that one-half of the sugar may be replaced by corn syrup. The malt syrups and dark cane syrups work very well in chocolate ice cream and may replace up to 40% of the cane sugar. J.H.E.

263. Low Sugar Ice Cream Mix. D. V. JOSEPHSON, Ohio State Univ. Ice Cream Rev., *28*, No. 12: 100. July, 1945.

Ice cream containing as low as 11% sucrose sugar content was judged to be palatable but it appeared somewhat "flat." Ice creams containing 12 and 13% sucrose sugar were considered quite palatable and refreshing and compared favorably with a product containing 14% sugar. J.H.E.

264. How to Stretch Sugar. A. J. HANTEN, Hudson Mfg. Co., Chicago, Illinois. Ice Cream Rev., *28*, No. 12: 37. July, 1945.

It is suggested that without disturbing the sugar content of an ice cream mix the milk solids not fat can be raised to about 13%. This type of mix will justify a greater overrun because of the increased food solids per gallon. Acidity control is mentioned as a way to eliminate the problem of lactose crystallization in high milk-solids-not-fat mixes. J.H.E.

265. Refrigeration for the Ice Cream Hardening Room. R. A. KLOKNER, The Vilter Mfg. Co. Ice Cream Rev., *29*, No. 4: 42. Nov., 1945.

This article explains a variation in arrangement of hardening room refrigeration coils. Vertical ammonia pipes spaced on 3-inch centers attached to headers at top and bottom are arranged around the walls of the room forming partitions or bays. Advantages claimed for this type of coil construction include: ease of defrosting, uniform distribution of temperature and elimination of special ceiling height. J.H.E.

266. Penicillin Ice Cream. ANONYMOUS. Ice Cream Rev., *29*, No. 4: 39. Nov., 1945.

Mixing penicillin with ice cream for administering the drug by mouth in the case of throat infections has been developed by the Navy. Ice cream proved to be an ideal carrier because penicillin retains its potency for a considerable period when kept in a chilled environment. Ice cream also meets test requirements, dissolves slowly and clings tenaciously to mucous membranes. J.H.E.

267. New Plant Construction. ANONYMOUS. Ice Cream Rev., *29*, No. 3: 44. Oct., 1945.

Floor plans are given for two new medium-sized ice cream plants that have recently been built. J.H.E.

268. Yes I Said a Billion. R. C. HIBBEN, Int. Assoc. of Ice Cream Mfgrs. Ice Cream Rev., *29*, No. 3: 42. Oct., 1945.

Ice cream consumption more than doubled in the past ten years, and prospects are exceedingly bright that it will again double in the next ten years to reach the total of one billion gallons. The article contains facts upon which the prediction is based. J.H.E.

269. Ideal Temperatures for Storing Frozen Foods. DONALD K. TRESSLER, Consultant, Westport, Conn. Ice Cream Field, *47*, No. 4: 74. 1946.

"In general it can be said that the lower the temperature of storage the longer any given food can be held without noticeable change in flavor, color and vitamin content." In most cases the above statment holds for texture as well, the author claims.

When stored at 10° to 15° F. most fish become tough and "chewy" in about 6 months, at 0° F. these changes require from 10 to 12 months and at −10° F. they are not apparent in less than a year.

The rate of loss of vitamin C is not the same for all vegetables, but the rate of loss of palatability and green color from vegetables usually parallels the rate of loss of vitamin C, hence vitamin C content is one of the best indices of quality for frozen vegetables.

A table is included which gives the approximate storage life of quite a variety of frozen foods at − 10° F., 0° F. and + 10° F.

The importance of proper packaging is emphasized and it is concluded that "The use of air-tight impervious containers will greatly increase the 'storage life' of any product at any given temperature." W.C.C.

270. Proposed Ice Cream Standards. MARK METCALF, Ice Cream Field, *47*, No. 4: 30. 1946.

Among the proposed standards which the Food and Drug Administration has sought to have adopted are the following:

Finished ice cream should contain not less than 12% by weight of milk fat. If nuts, fruits, confectionery products, etc, are used it must contain a minimum of 10% milk fat.

Ice cream must contain not less than 1.6 pounds of total solids per gallon and weigh not less than 4.5 pounds per gallon.

Ice cream shall contain not less than 10% by weight of fruit, juice or both, and if such products are used no other natural or artificial flavor can be used which imitates the flavor of fruit or its juice.

Nut ice cream shall contain not less than 6% by weight of properly prepared nuts.

Ice cream may not contain any ingredient which imitates the flavor of milk, cream, butter or egg.

Egg solids may be used in the form of liquid, dried or frozen eggs or yolks provided they are used to 1½ to 2% of the weight of finished ice cream. (Exact percentage to be fixed after hearing and will apply to frozen custards.)

Sherbets must contain fruit ingredients from 10% to 20% by weight. (Exact percentage to be fixed following hearing.) Sherbets should contain not less than 2% fat and weigh 6 pounds per gallon.

Sweetening agents which the Food and Drug Administration would permit include sugar, dextrose, invert sugar sirup, corn sirup, maple sirup or sugar, honey, brown sugar or molasses.

Labels are required to state specifically when any artificial flavoring is used. W.C.C.

271. **Cane Sugar.** B. W. DYER AND COMPANY, Sugar Economists and Brokers, New York City. Ice Cream Field, *47*, No. 4: 22. 1946.

It is expected that there will be a 60 per cent allotment rate for sugar the third quarter of 1946. Total 1946 civilian supplies will likely be about 5.5 million tons versus 5.1 million tons in 1945.

Liberated countries of Europe—largely sugar deficit areas—are now claimants for sugar and other foods from the United Nations supplies. The Japanese occupation materially reduced sugar production in Java and it is predicted that it will likely be 1949 before Java can export in volume.

The United Kingdom which normally received the Mauritius and Natal sugars now will demand more Cuban sugar to make up this loss. At present the United States is shipping sugar to the Philippine Islands instead of receiving nearly one million tons annually from them. W.C.C.

272. **Corn Sugar.** G. B. HAMILTON, American Maize Products Co. Ice Cream Field, *47*, No. 4: 22. 1946.

It is stated that corn sweeteners will be shorter this year than any time during the war. Since 1942, when corn supplies were adequate there has been a decrease each year in the corn available for use in manufacturing sweeteners. The author considers that the critical situation which now exists is due to the following factors: (1) Worldwide grain shortage. (2) Shortage of animal feeds. (3) Large number of animals on farms and in feed lots. (4) Farmers can receive more for their corn by feeding it than by selling it. (5) Tendency for farmers to hold corn in hopes of securing high prices. (6) Order expected April 1 limiting grind for sweeteners to 85% of 1945 quota. W.C.C.

273. **Fruits–Berries.** F. J. OWENS, Brown Packing Co. Ice Cream Field, *47*, No. 4: 20. 1946.

In January 1946 an over-all picture showed the market long on frozen

apples, peaches and plums and short on strawberries, raspberries and other desirable berries.

Strawberry acreage has been increasing but raspberry acreage has decreased. It is stated that the only hope dairies have of securing adequate supplies of strawberries is the removal of price ceilings by OPA.

Puerto Rico and Cuba are expected to market as much of their pineapple crop as possible on the fresh market largely because of ceiling prices on canned fruit. Hawaii will be unable to supply a normal pineapple crop for several years due to lack of plantings because of military installations also because of dry weather.

All desirable berries will be short again this year but indications are that peaches and other tree fruit will be plentiful. W.C.C.

274. Chocolate Outlook. S. K. BLUMENTHAL, Vice-President, Blumenthal Bros. Ice Cream Field, *47*, No. 4: 19. 1946.

The rationing program on chocolate and cocoa imposed during the war is credited with materially improving conditions in the industry. It is predicted that rationing will continue for another year after which it is expected that supplies will permit production according to demands. European demands will have to be met at least in part which will reduce our supplies. Furthermore it is stated that imposed ceiling prices may prevent the United States from meeting prices paid by other countries and this in turn limit local supplies. W.C.C.

275. Cabinets—Fountains. J. J. NOONAN, Fountain-Cabinet Division, Liquid Carbonic Corp. Ice Cream Field, *47*, No. 4: 17. 1946.

Lack of material, shortage of skilled manpower as well as strikes have contributed to the shortage of ice cream cabinets and equipment for the soda fountain. Data available indicate the soda fountain industry was producing about 50 per cent of normal production capacity the first quarter but expectations are that the second quarter of 1946 would reach 75 per cent of normal production capacity. Due to lack of inventories it was predicted that customers would be likely to get about 50 per cent as much soda fountain equipment as they were able to obtain in a comparable period in 1941.

The ice cream cabinet situation is very similar to that for soda fountain equipment. The electrical strike shut off the supply of fractional motors and materially delayed ice cream cabinet production since most cabinets are of the self-contained chest type. Lack of inventory and delayed production will likely keep the supply of cabinets to about half those available during a corresponding period in 1941. W.C.C.

276. The Freezer Situation. DON LIGHTNER, Creamery Package Mfg. Co. Ice Cream Field, *47*, No. 4: 16. 1946.

Ice cream freezer manufacturers are hampered in their efforts to supply

orders for equipment by lack of supplies and inadequate trained personnel. Priorities have been removed, they are filling rated orders ahead of unrated or "postwar" orders and it is stated that only a small percentage of the orders can be filled by this summer.

It is suggested that ice cream manufacturers can help by projecting their requirements over a three- to five-year period; also by eliminating duplicate orders placed with more than one freezer manufacturer. W.C.C.

277. Use of Eggs in Ice Cream. LEO D. OVSON, Ovson Egg Co., Chicago. Ice Cream Field, *47*, No. 5: 66. 1946.

It is stated that originally eggs were added to ice cream mainly to improve whipping properties, whereas now the primary reason is to increase the "richness" of ice cream. Other advantages listed for eggs in ice cream are: (1) increases smoothness, (2) improves whipping properties of mixes, (3) enhances food value of ice cream, (4) makes ice cream more resistant to melting and (5) increases emulsifying action thereby improving fat dispersion.

According to the author 26 states have laws governing the quantity of egg solids in French ice cream and frozen custard. W.C.C.

MILK

278. Practical H.T.S.T. Operation Shows Ease of Control. M. SIMPSON, Canadian Dairy and Ice Cream Jour., *25:* 4. April, 1946.

The operator must understand his machine to secure uninterrupted pasteurization and it will be found that the highest quality of milk is necessary. The author lists the advantages of H.T.S.T. as follows: (1) less labor is required for operation; (2) filling can be started shortly after milk is received; (3) less floor space is required; (4) continuous operation; (5) better flavor and as good a cream line; (6) a completely closed system; (7) an automatic system; (8) less time required for cleaning; (9) controls assure proper pasteurization; (10) controls assure uniform pasteurization; (11) operator can't reduce holding time to suit his will. H.P.

279. Observations of Milk Can Washing by the Acid Method. L. R. BRYANT. Canadian Dairy and Ice Cream Jour., *25:* 3. March, 1946.

The results are based upon comparisons made between acid washing and alkaline washing of market milk cans, on a small commercial scale, using an ordinary small rotary type can washer at the rate of about 100 cans per day.

The observations made would indicate that hydroxyacetic acid and the detergent of the sodium hydrocarbon sulfonate type, when used as an acid

can-washing solution, produce a marked improvement in the sanitary condition of the cans, as judged by odor, and in the bacteriological condition based upon the types of bacteria in the washed cans. More work is needed upon the possible corrosion effect of long time use of this acid solution upon the can-washing machine itself. A bibliography on acid can washing and related subjects is presented. H.P.

280. A Selection System for Route Salesmen and Other Personnel. J. H. DUPLAN. Canadian Dairy and Ice Cream Jour., *25:* 1. January, 1946.

Personnel must be carefully selected to build a good staff and strengthen confidence in the dairy industry. Some of the advantages of careful selection of milk route salesman are: (1) qualified sales force; (2) reduced turnover of routemen; (3) increased consumption and sale of dairy products; (4) reduced unit of sale operating cost; (5) higher prestige for route work as a vocation; (6) increase in good will for the industry; (7) satisfaction, happiness, and success for employee and employer. A manual published by International Association of Milk Dealers contains a list of important factors to be answered by applicant. They are mental ability, personality traits, personal history, educational background, experience background, financial standing, memberships, activities, and contacts, family standing and references. H.P.

281. L'épreuve de la Réductase dans le Controle de la Quanlité des Lait Pasteurisés. (The Reductose Test in the Quality Control of Pasteurized Milk.) A. EYRARD AND MLLE. S. REY. Le Lait, *23:* 229–230. 1943.

The authors report experimental work indicating that, on the average, methylene-blue-reduction-times of less than one hour are indicative of counts approaching 3,000,000 organisms per ml. in pasteurized milk while decreasing counts (160,000 equal to 6 hours) are associated with longer reduction times. The test lacks sensitivity at these limits. It is of value however as a rough guide as to the care with which the pasteurization process has been carried out, the extent of recontamination and the conditions under which the sample has been held after pasteurization. O.R.I.

282. Evaluation of Factors in the Processing of Homogenized Milk. E. M. GIBERSON, Medosweet Dairies, Ind. Tacoma, Washington. Milk Plant Monthly *35*(5) : 24–25, 54–56, 60. 1946.

The author outlines extensively the various factors to be considered in the homogenization of milk, giving the advantages, disadvantages, and precautions in homogenizing milk when using either holder type or high-tem-

perature short-time pasteurization. Clarification and filtration fully discussed.

The conclusion is reached that the consumption of homogenized milk will continue to increase as people become acquainted with its merits. Homogenizing milk equipment requires a considerably larger capital investment in milk processing. The capital outlay must be sufficiently great to enable homogenization at a low cost. An adequate system will allow the processor of homogenized milk to sell a uniform-quality product at no extra cost to the consumer. G.M.T.

283. Can Milk Distribution Cost Be Lowered? ROLLAND W. BARTLETT, Professor of Agricultural Economics, University of Illinois, Urbana, Illinois. Milk Plant Monthly, *35*(4) : 24–25, 84. 1946.

The author is convinced that in the next few years low-cost high-quality homogenized milk sold through stores will be the pace setter in the field of milk distribution. Reasons are cited for this belief. Dealers with costs for receiving, processing, bottling, administrative, selling and delivery of milk to stores not greater than 2½ to 3 cents per quart, need have little fear of post-war competition. Dealers whose wholesale costs are more than 3 cents per quart should give careful consideration to methods which will bring about more efficient operation. Cost studies are presented on retail and wholesale distribution both for paper and glass containers. No relationship seems to exist between unit costs and volume. Serious consideration should be given to the lowering of marketing costs through the use of efficient plant layouts, use of modernized machinery, reduction in plant losses, introduction of more efficient selling and delivery methods and other practical efficiency methods. G.M.T.

284. The Place of the Laboratory in a Milk Sanitation Program. C. A. PERRY, Director, Laboratory State Department of Health, Maryland. Milk Plant Monthly, *35*(4) : 26, 66–68, 83. 1946.

Since the function of the laboratory in a program of milk sanitation is to provide evidence as to the chemical and bacteriological quality of the milk, the milk regulations in various municipalities will determine the types of tests to be run in the laboratory.

Attention is called to the Standard Methods of Milk Analysis, keeping pace with dairy sanitation programs. This is an extensive manual, divided into four parts, which covers the following: (a) microbiological methods for the examination of milk, cream and butter, (b) microbiological methods for the examination of frozen desserts and ingredients of frozen desserts, (c) bioassay of Vitamin D milk, and (d) chemical methods.

Special attention is given to the tests used in Maryland in the milk sanitation program. The chief functions of the State Health Department

laboratories are: (1) to make highly dependable bacteria and chemical examinations, (2) to study control measures, helping to solve problems affecting quality of milk from dairy to consumer, (3) to collaborate with milk sanitarians and inspectors in facilitating a fuller understanding of laboratory methods and findings and their interpretations, and (4) to exercise general control through advice and aid to all laboratories doing routine laboratory work. G.M.T.

285. A Comparison of the Cleansing of Square and Round Milk Bottles Under Regular Commercial Conditions. T. V. ARMSTRONG AND L. H. BURGWALD, Dept. of Dairy Technology, Ohio State University. Milk Plant Monthly, *35*(3): 30, 32, 34. 1946.

Bacteriological studies made on the cleansing of round and square milk bottles under regular commercial conditions were made. The study involved different size bottles. Data secured show that in some instances square bottles have average counts slightly lower than round bottles. In other instances lower average counts were encountered on round bottles. Transition from the use of one type of bottle to another might account for accumulated sediment, removable with difficulty, and hence poorer washing, thus involving slightly higher counts. While the number of bottles involved in this study seemed inadequate for an exhaustive bacteriological study, the results did indicate that added difficulty for washing and sterilizing of the square bottle need not present a problem. G.M.T.

286. The Control of the Quality of Milk Supplies. HERMAN N. BUNDESEN, M.D. President Board of Health, Chicago. Milk Plant Monthly, *35*(2): 25–26. 1946.

Milk needed in the diet of all mankind must be free from communicable disease organisms as well as have proper food value. The quality of milk is appraised by health authorities according to legal requirements governing milk production in their respective communities. These requirements usually cover inspection of dairy farms and milk plants, bacterial content of the milk and the regulation of other procedures involved in milk production.

Milk quality in many areas has deteriorated during the war years. Despite this lowering of quality, milk-borne diseases have been kept at a minimum.

The assumption is that conditions with respect to dairy farm labor and supplies will soon return to normal, and that superiority of milk quality will be regained. To this end cooperation is necessary between the milk producer and the health departments. Since cooling of milk is so important in maintaining quality of milk, milk control officials yet may have to contend with unduly high bacteria counts during the summer until artificial re-

frigeration becomes common for cooling milk on dairy farms. Likewise, the question is raised concerning the improvement of quality of milk if the cows are milked in a separate milking parlor.

Certification of properly sanitized hauling tanks as to the date, hour and place of cleaning and personnel involved is being prescribed by the Chicago Board of Health. United efforts of milk producers and distributors in health departments are essential. G.M.T.

PHYSIOLOGY

287. The Quantitative Determination of Thyroxine in Iodinated Casein Having Thyroidal Activity. E. P. REINEKE AND C. W. TURNER, Dept. of Dairy Husbandry, University of Missouri, Columbia, and GEORGE O. KOHLER, R. D. HOOVER, AND MARGARET B. BEEZLEY, Cerophyl Laboratories, Inc., Kansas City, Missouri. Jour. Biol. Chem., *161*, No. 2: 599–611. 1945.

Iodinated proteins having a high thyroidal activity have been shown to actually contain thyroxine. Chemical methods for estimating the potency of such preparations have usually been employed. This report compares the biological assay and a chemical extraction method. The method is based upon the hydrolysis of the iodinated casein with 40 per cent barium hydroxide solution, extraction with n-butanol and determination of the iodine content of the purified extract. Correlation between the bioassay and chemical method is fair, ranging from −25.3 per cent to +7.8 per cent. Fifteen iodinated casein preparations showed an average thyroxine content of 2.79 per cent determined biologically and 3.04 per cent by the chemical extraction method. A.O.C.

288. The Effect of Manganese Compounds and Certain Other Factors on the Formation of Thyroxine in Iodinated Casein. E. P. REINEKE AND C. W. TURNER, Dept. of Dairy Husbandry, University of Missouri, Columbia. Jour. Biol. Chem., *161*, No. 2: 613–619. 1945.

The effect of several factors such as temperature of incubation, degree of agitation and the addition of various manganese salts in the preparation of iodinated casein is discussed.

It is believed that manganese may act as a catalyst, both *in vivo* and *in vitro*, in the oxidative process of coupling two diiodotyrosine radicals and eliminating a side chain to form thyroxine. A.O.C.

MISCELLANEOUS

289. Opportunities in Retail Trade for Service Men. ANONYMOUS. Ice Cream Rev., *29*, No. 4: 98. Nov., 1945.

This is a digest of a brochure recently published by Dun and Bradstreet

intended to offer guidance to discharged veterans contemplating a retail enterprise. Requirements for successful management have proven to be: personal aptitude, knowledge of the line of business, selection of location and working capital. J.H.E.

290. Container and Packages. J. C. La Grua, National Folding Box Co. Ice Cream Field, *47*, No. 4: 19. 1946.

The demand for paper packages is greater than the supply. Lack of raw material—wood pulp and reclaimed fibrous material—is primarily responsible for this condition although no new equipment has been available since prior to the war. Normally Sweden supplied considerable wood pulp but wood is being burned in Sweden due to lack of coal. Canadian and domestic production of pulp is being hampered by a shortage of labor. Since the end of the war lack of interest in saving waste paper contributes to the lack of reclaimed paper. Decreased government uses of paper has relieved the situation somewhat. W.C.C.

291. Dairy Plant Sanitation Must Be Thorough and Continuous. W. E. Noyes. Canadian Dairy and Ice Cream Jour., *25*, 4. April, 1946.

The article discusses careful training of employees with the aim of showing them the value of thorough sanitation in dairy work for company success and for their own personal advancement. H.P.

292. Practical Suggestions for Plant Sanitation. James T. Smith, Telling-Belle Vernon Co., Cleveland, Ohio. Nat. Butter & Cheese Jour. *37*, No. 4: 40. April, 1946.

Cleaning is just as important as any dairy plant operation. It requires properly trained personnel. Careful plant layout facilitates cleaning by allowing sufficient and convenient working space. Elimination of unnecessary pumps, fittings and overhead sanitary pipelines simplifies clean-up. Adequate light and ventilation for efficient, comfortable work are essential. For highest efficiency, workmen need clean, comfortable clothing, non-slip, water-proof footwear, and locker room facilities for their personal cleanliness. W.V.P.

293. How to Improve Coal Utilization and Boiler Efficiency. Theodore O. Phillips, Bituminous Coal Inst., New York, N. Y. Nat. Butter & Cheese Jour., *37*, No. 4: 50. April, 1946.

Select an economical, dependable coal supply. Get equipment to use this coal effectively and operate it according to expert engineering advice so that the coal will be completely burned with minimum loss of combustible gases. Use optimum rate of feed, control the air supply and maintain a clean boiler for best utilization of coal. W.V.P.

ERRATA

Abstract #170, Vol. XXIX, No. 6, June, 1946, page A84—title should read: **Bulk Freezing for Commercial Use.**

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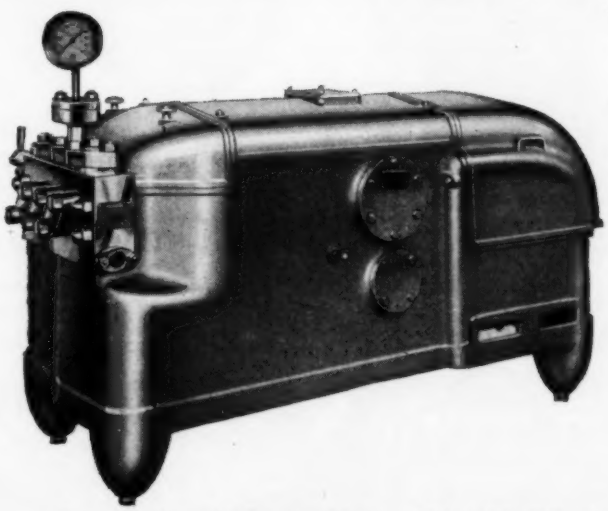

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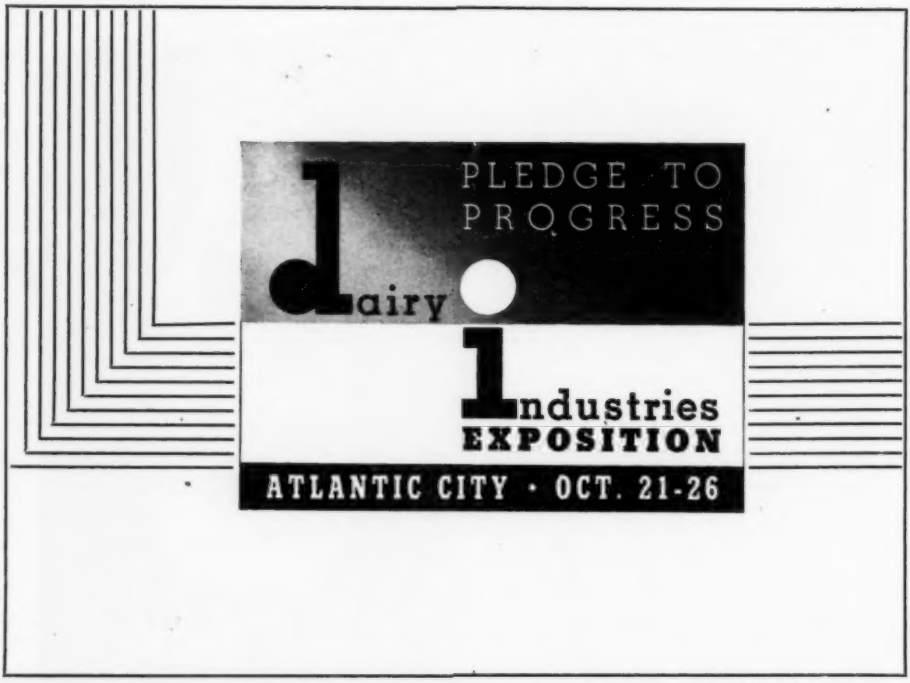

DAIRY SCIENCE ABSTRACTS

A Digest of Current Research On Milk and Milk Products

THE IMPERIAL BUREAU OF DAIRY SCIENCE, SHINFIELD, READING, ENGLAND searches the world's scientific literature for publications giving new information about milk and milk products, and prepares abstracts which are published in the Bureau's quarterly journal *Dairy Science Abstracts.* These abstracts are specially prepared for research workers, teachers and advisory and control officials. Further details of any publication abstracted can be obtained from the Bureau.

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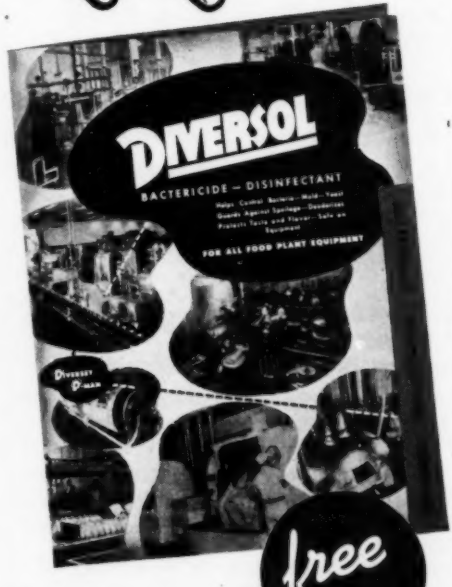

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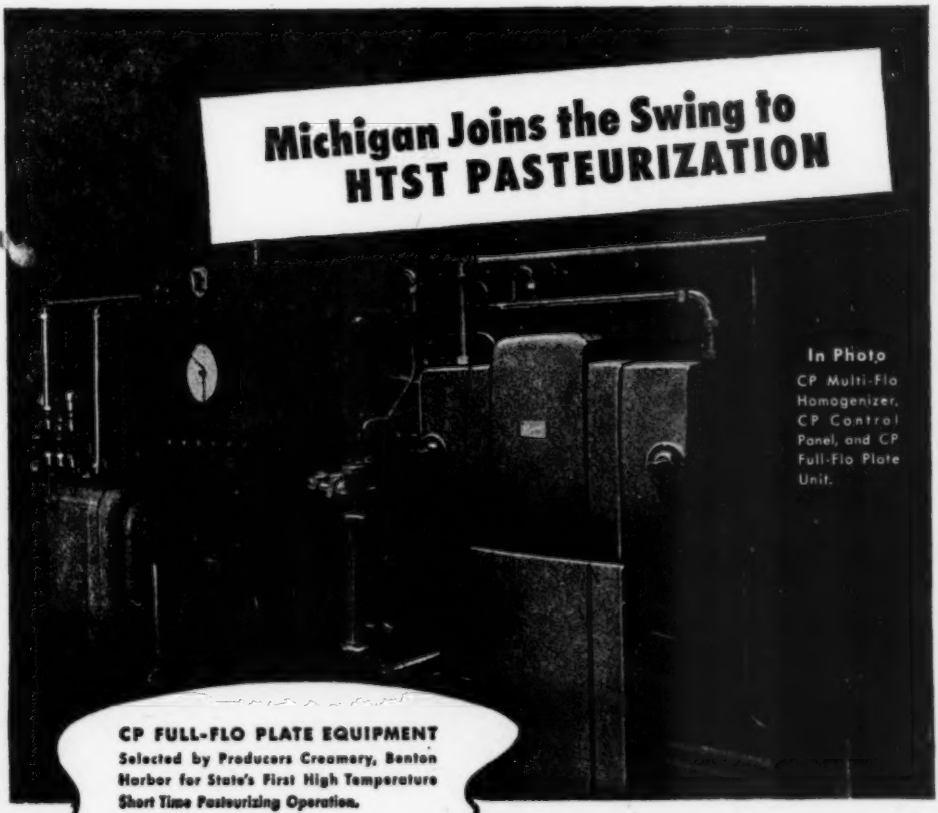

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